Anderson

THESIS
AND
REPORTS
Anderson, Terry

FINAL REPORT

AVAILABILITY OF WOOD RAW MATERIALS AT SELECTED ROCKY MOUNTAIN LOCATIONS

RM Research Agreement No. 16-546-CA

CSU Project No. 2130

March, 1976

Department of Forest and Wood Sciences
Colorado State University
Fort Collins, Colorado 80523

LIBRARY

APR 26 1976

ROCKY MOUNTAIN STATION

FINAL REPORT

AVAILABILITY OF

WOOD RAW MATERIALS AT

SELECTED ROCKY MOUNTAIN LOCATIONS

Submitted to Rocky Mountain
Forest and Range Experiment Station,
United States Forest Service

RM Research Agreement No. 16-546-CA

CSU Project No. 2130

March, 1976

Prepared by: Terry Anderson, Gene Downey, H. E. Troxell,
D. R. Betters, and F. F. Wangaard

Department of Forest and Wood Sciences
Colorado State University
Fort Collins, Colorado 80523

TABLE OF CONTENTS

	Page
SUMMARY	1
THE PROBLEM	4
INTRODUCTION	4
STUDY OBJECTIVES	6
METHODOLOGY	6
Site Selection	6
Boundary Determination	7
Classification System	8
Estimating the Resource Volume Tributary to Each Site	11
Information Sources	11
Inventory Data Analysis	11
Mortality and Logging Residues	15
Estimates of Expected Cut	15
Definition of Terms	16
Processing Information	17
Economic Considerations for Each Site	18
Other Considerations	20
REFERENCES	22
ACKNOWLEDGEMENTS	25
GLOSSARY	26
CASE STUDY I: Whitewood, SD and Newcastle, WY.	I-1
CASE STUDY II: Saratoga, WY and Fort Collins, CO.	II-1
CASE STUDY III: Pagosa Springs and Montrose, CO.	III-1
CASE STUDY IV: Reserve and Española, NM.	IV-1
CASE STUDY V: Flagstaff and Whiteriver, AZ.	V-1

Summary

This report represents a first effort at determining, from best available data, the types and quantities, costs and values of wood raw materials that are available for utilization at specific processing centers in the five-state area consisting of western South Dakota, Wyoming, Colorado, Arizona, and New Mexico. The ten processing centers selected for this study were Whitewood, SD; Newcastle, WY; Saratoga, WY; Fort Collins, CO; Montrose, CO; Pagosa Springs, CO; Española, NM; Reserve, NM; Whiteriver, AZ; and Flagstaff, AZ. The area tributary to each processing site was determined on the basis of reasonable expectations about the resources that would be available to that center in the "foreseeable future."

All possible sources of information were consulted in compiling data for this study including the Forest Survey Unit of the U. S. Forest Service at Ogden, Utah; Regional Offices of the U. S. Forest Service Regions 2 and 3; National Forest timber management officers; U. S. Bureau of Indian Affairs; State Foresters; staff of the Rocky Mountain Forest and Range Experiment Station; and forest industry representatives at each of the processing centers. Available literature from many of the foregoing sources, among others, was also consulted.

The principal findings of the research are presented in a series of case studies, one for each selected processing site. A summary table containing the principal results of the resource inventory available to each site is presented as Table 1. More detailed inventory information broken down by ownership categories and production information by type of product, costs and values of products at the mill, as well as by-product and residue information is presented in each individual case study section of this report.

In the course of compiling this information it was necessary to develop a methodology described in detail in this report, which may be useful in parallel studies of other sites and one that lends itself to further refinement as more accurate data become available.

TABLE 1. AREA AND VOLUME SUMMARY TABLE FOR SITES EXAMINED

	Whitewood, S. D.		Newcastle, WYO.		Saratoga, WYO		Fort Collins, CO.		Montrose, CO.	
	Area (Acres)	Volume (MCF)	Area (Acres)	Volume (MCF)	Area (Acres)	Volume (MCF)	Area (Acres)	Volume (MCF)	Area (Acres)	Volume (MCF)
Living Material										
Total Sawtimber	286,215	499,571	284,214	473,267	182,897	271,409	226,484	350,012	332,472	961,518
Total Poletimber	89,658	106,649	148,362	139,346	73,833	83,732	359,693	383,957	218,542	316,810
Total Seedling & Saplings	14,982	3,694	12,085	1,727	31,075	10,938	45,386	22,116	37,760	12,753
Total Rough Material	N/A	7,974[1]	N/A	7,286[1]	N/A	6,584[1]	N/A	4,478[1]	N/A	37,731
Total Rotten Material	N/A	2,187[1]	N/A	1,959[1]	N/A	5,204[1]	N/A	11,176[1]	N/A	83,116
Dead Material										
Total Standing Dead	N/A	N/A	N/A	N/A	N/A	18,248[1]	N/A	41,835[1]	N/A	74,589[1]
Total Down Dead	N/A	N/A	N/A	N/A	N/A	89,495[1]	N/A	176,628[1]	N/A	55,116[1]
Total Dead	N/A	3,420[1]	N/A	2,893[1]	N/A	107,743[1]	N/A	218,463[1]	N/A	129,705[1]
Annually Generated										
Total Logging Residue	N/A	846	N/A	386	N/A	362[1]	N/A	1,328	N/A	647[1]
Total Mortality	N/A	6,778[1]	N/A	3,843[1]	N/A	1,489[1]	N/A	9,246[1]	N/A	3,072[1]
Total Annual Programmed Allowable Cut	N/A	8,649	N/A	14,082[1]	3,851[1]	4,710	4,652[1]	4,800[1]	9,380[1]	4,698[1]

N/A Data Not Available

[1] Incomplete Data - Value Represents Summation Of Those Data Available.

TABLE 1, contd. AREA AND VOLUME SUMMARY TABLE FOR SITES EXAMINED

	Pagosa Springs, CO.		Española, N.M.		Reserve, N.M.		Whiteriver, AZ.		Flagstaff, AZ.	
	Area (Acres)	Volume (MCF)	Area (Acres)	Volume (MCF)	Area (Acres)	Volume (MCF)	Area (Acres)	Volume (MCF)	Area (Acres)	Volume (MCF)
Living Material										
Total Sawtimber	72,215	135,743	52,102[1]	52,340[1]	81,496[1]	100,242[1]	532,086	719,009	487,053[1]	637,663
Total Poletimber	29,165	49,642	5,040[1]	8,481[1]	1,010[1]	10,000[1]	8,320	1,612	66,362[1]	127,000
Total Seedling & Saplings	1,527	1,084	N/A	N/A	N/A	N/A	N/A	N/A	26,761[1]	N/A
Total Rough Material	N/A	1,769[1]	N/A	9,915[1]	N/A	5,632[1]	N/A	N/A	N/A	22,340[1]
Total Rotten Material	N/A	4,906[1]	N/A	3,952[1]	N/A	29[1]	N/A	N/A	N/A	2,636[1]
Dead Material										
Total Standing Dead	N/A	5,926[1]	N/A	2,922[1]	N/A	794[1]	N/A	24,093[1]	N/A	5,704[1]
Total Down Dead	N/A	N/A	N/A	11,127[1]	N/A	1,172[1]	N/A	N/A	N/A	N/A
Total Dead	N/A	N/A	N/A	14,049[1]	N/A	1,966[1]	N/A	N/A	N/A	N/A
Annually Generated										
Total Logging Residue	N/A	185	N/A	251	N/A	1,162	N/A	2,245[1]	N/A	2,441
Total Mortality	N/A	495[1]	N/A	328[1]	N/A	446[1]	N/A	4,378[1]	N/A	1,299[1]
Total Annual Programmed Allowable Cut	N/A	1,769[1]	3,934[1]	2,060	6,358	9,537	N/A	18,400	41,970[1]	15,941

N/A - Data Not Available

[1] Incomplete Data - Value Represents Summation Of Those Data Available.

AVAILABILITY OF WOOD RAW MATERIALS AT SELECTED ROCKY MOUNTAIN LOCATIONS

The Problem

A major obstacle to efficient utilization of Rocky Mountain timber is lack of information on the types and amounts of wood raw materials available at specified processing points, and on their delivered costs and values. This study is a first effort in developing the methodology needed to produce such information.

Introduction

The McSweeney-McNary Forest Research Act of 1928, among other provisions, directs the Secretary of Agriculture to cooperate with states and other agencies

> "... in making and keeping current a comprehensive survey of the present and prospective requirement for timber and other forest products in the United States, and of timber supplies, including a determination of the present and potential productivity of forest land therein, and of such other facts as may be necessary in the determination of ways and means to balance the timber budget of the United States...."

This Act provided much of the impetus needed to develop data periodically concerning the supply and demand situation for wood and wood fiber in various areas of the United States. The information gained has proved to be very beneficial in determining the amounts and characteristics of wood raw materials available in general geographic sections of the country.

For example, according to the latest U.S. Forest Service summary the five-state area of particular concern in this study -- western South Dakota, Wyoming, Colorado, Arizona and New Mexico -- supports 29.1 billion cubic feet of growing stock on commercial timberland. In this area 242 million cubic feet, or only 0.8 percent of the inventory, is annually harvested as roundwood. In this area the growing stock on commercial timberland alone has a net annual growth of 377 million cubic feet, roughly 1 1/2 times the present roundwood harvest. Present

growth is also much less than the potential which could be attained from conversion of old growth to vigorous young-growth stands.

In 1970, in addition to the 242 million cubic feet harvested, an estimated 21 million cubic feet remained on the logging site as residuals of logging operations. Another large source of potential raw material is 4.7 billion cubic feet of rough, rotten and salvable dead standing trees in the five-state area.

A large quantity of unused residues is also generated annually at primary manufacturing plants in the entire Rocky Mountain area estimated at 139 million cubic feet. This is 16 percent of the 863 million cubic feet of total roundwood products harvested annually in the Rocky Mountains. We estimate that 35 million cubic feet of these mill residues are generated within the five-state area referred to above. By comparison, in the South, only 6.3 percent of the roundwood harvested is classified as unused residues from primary manufacturing plants.

There has been much concern in recent years directed toward maximizing the utilization of all wood raw materials to meet national product needs, improve the environment, and conserve energy. This utilization effort includes not only growing stock, but also logging residue, salvable dead and down material, rough and rotten material, and manufacturers' byproducts.

To encourage increased utilization of these resources, this report will examine and compile detailed information concerning the following:

1. Inventory volumes. What is the volume of utilizable wood material, by class, available in areas tributary to specific processing sites?
2. Average production costs. What is the average cost of harvesting and delivering these classes of material to specified sites?
3. Product values. What are the average values at the processing sites of these various classes of raw materials by end products, using present technology?
4. Volumes used. How much of each class of raw material is now unused at each processing site?

With answers available to these questions, individuals and firms involved, or wanting to be involved, in a local timber industry, should be better able to determine the nature and size of the resource available to them. Forest managers and communities should be in better position to identify viable utilization opportunities.

Study Objectives

The primary objective of this study is to estimate from best available data, the volumes, costs, and values of merchantable and nonmerchantable roundwood and forest and mill residues tributary to ten selected processing centers in southern and eastern Rocky Mountain states, specifically: Whitewood, South Dakota; Newcastle, Wyoming; Saratoga, Wyoming; Fort Collins, Colorado; Montrose, Colorado; Pagosa Springs, Colorado; Española, New Mexico; Reserve, New Mexico; Whiteriver, Arizona; and Flagstaff, Arizona. A secondary objective of the study is to develop a methodology that can be used for parallel analyses in other localities and one that lends itself to further refinement as more accurate data become available.

Methodology

Site Selection

Ten processing sites, located in five Rocky Mountain states, were chosen as case studies for this analysis. The criteria for selection included, 1) existence and financial health of the local timber industry, 2) presence of transportation networks suitable for use by forest products industries, 3) quantity of available commercial timber, 4) dominant commercial species, and 5) the area's topographic features.

One other factor considered in site selection was the uniqueness of an area. It was important that a variety of situations be considered; however, it is not claimed that the sites studied are necessarily representative of the entire region. The selected sites therefore represent several different geographical regions, different types of forest products industries, various kinds of available transportation systems, different ownerships and/or management systems of timber sources, different dominant species, and different types of geographical features.

Boundary Determination

After each processing site was selected, it was necessary to determine the area considered tributary to the particular site. The resource picture within these particular boundaries is the main consideration of this study.

The area tributary to a particular site was determined on the basis of reasonable expectations about the resources that could be made available to the processing center in the "foreseeable future." In an area where National Forest land was the primary source of timber tributary to a particular site, the time frame of the forest's current Timber Management Plan (TMP) was used to define "foreseeable future."

Usually these TMPs span a ten-year period. If timber management plans for other ownerships were available, the time frame for which they were applicable was used. For areas where no management plans existed, a "foreseeable future" of ten years was assumed arbitrarily.

In Region 2 of the U. S. Forest Service, information concerning tributary area boundaries was obtained from individual Timber Management Officers of the various National Forests near the selected sites. In each case the officers were asked to illustrate on a map the area from which timber was currently being procured or was expected to be within the "foreseeable future." They were asked to include any harvesting information within their knowledge, on state and private land, as well as other federally owned land. The boundaries received from the various timber management officers were then reviewed with other agencies controlling land included in the boundary.

The boundaries for the tributary areas in Region 3 of the U. S. Forest Service were obtained from the Regional Office in Albuquerque, New Mexico. The boundaries were then reviewed with the individual managers of the land included. In some cases changes had to be made after local consultations. The resulting tributary area for each site is illustrated on the map included in each individual case study.

Classification System

A classification scheme for wood raw materials, Figures 1 and 2, was developed that could be used to represent the resource situation within any particular area. Due to the wide variety of forms in which wood fiber may exist, it can be described in different ways, such as sawtimber versus pole timber, live versus dead timber, or rotted versus sound timber. Furthermore, because of the different ways that wood is utilized, there exist corresponding differences as to the type of material that best fits a particular type of use. The taxonomy that was developed therefore reflects not only the forms in which these materials are found or generated, but also the forms in which they can be utilized.

The taxonomy was developed using three criteria. First, to take advantage of available data sources, it was stipulated that the system should use existing terminology as much as possible in describing the various types of wood resources. Existing definitions were therefore used for most categories. One exception to the existing terminology was in the "dead-down" category. Up to this time, definitions of salvable dead material have included only those dead trees that were standing at the time of the inventory. Because the dead-down category represents considerable volume in some forest types, it was included in the new taxonomical scheme.

Second, the taxonomy developed also had to reflect adequately the resource as it existed at a particular point in time. Each category in the taxonomy, therefore, had to be mutually exclusive, not only as to source but as to time. Also each successively higher category must aggregate those categories below it. Since logging residues and future mortality volumes are indistinguishable from other downed resources, they are treated as additive amounts that can be applied to existing inventories on a quantity-per-time-period basis.

Finally, a classification scheme must entail a logical flow from qualitative data, such as source, to quantitative information such as size. With the exception of growing stock, this type of information is not available

Figure 1. Taxonomical scheme for wood resources available from the forest.

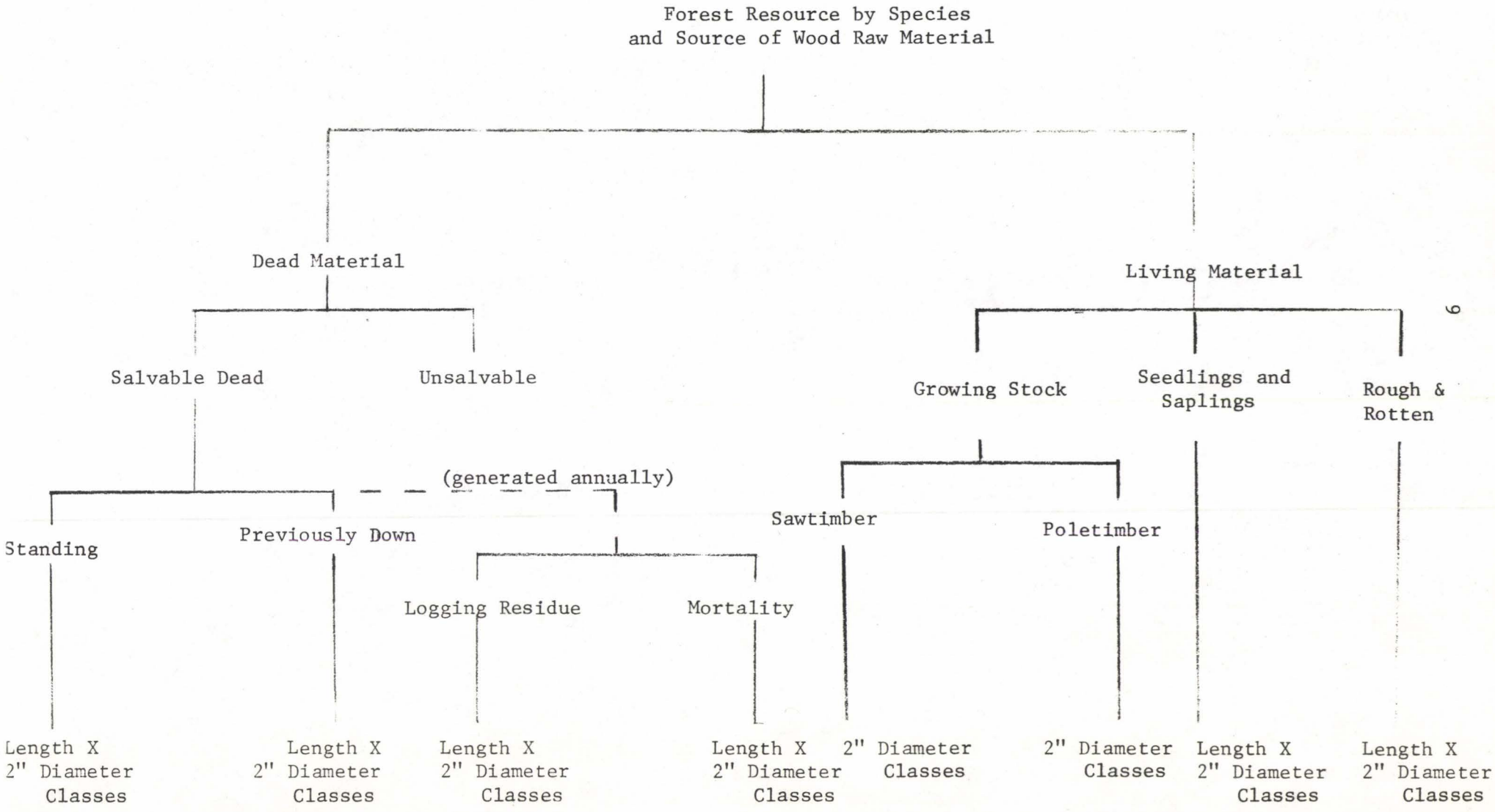
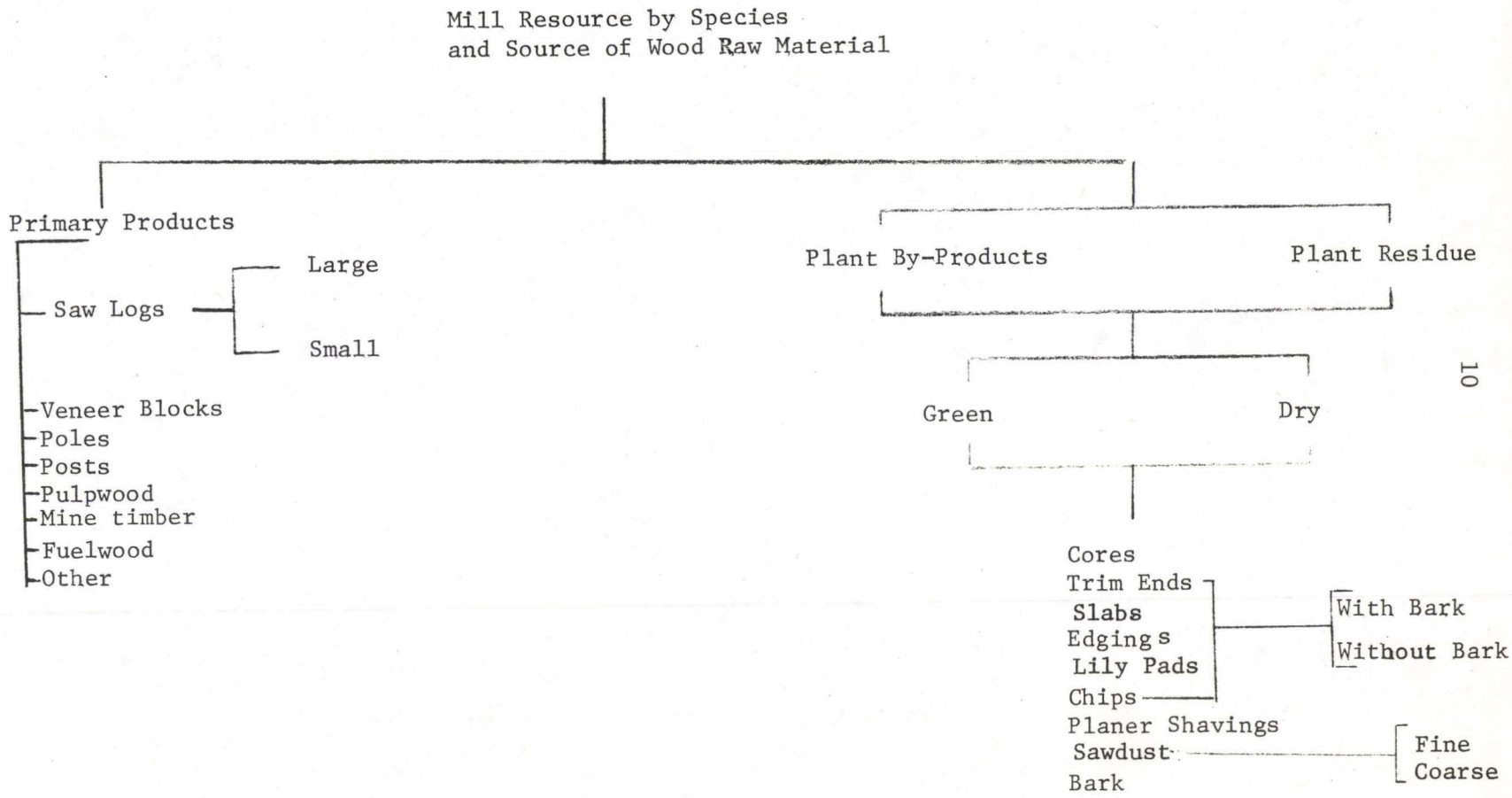


Figure 2. Taxonomical scheme for wood resources available from the mill site.



in current taxonomies. However, in the future more sophisticated inventory techniques, coupled with computerized information systems, may make recovery of such detailed information possible. If size were included with each source of raw material, then a prediction of the potential method of utilization could be made for the volume figures. For example, the volume of dead material 16 feet long and 20 inches in diameter has a different product potential than the volume of sawlogs of the same size cut from the live timber, or the volume of other dead material of a somewhat smaller size.

A glossary defining the terms used in this taxonomy, as well as other terms used throughout this report, is included in an Appendix.

Estimating the Resource Volume Tributary to Each Site

Information Sources -- After development of the resource classification scheme, the next step was to determine the volume of each resource type, by species, tributary to each site. There was no primary collection of data. When available, basic quantitative data for the timber resource were derived from inventory listings supplied by the Forest Survey Unit, Intermountain Forest and Range Experiment Station, Ogden, Utah. Additional information came from the respective Regional and State Foresters. Information was also solicited from local companies and individuals involved in the timber enterprise.

Inventory Data Analysis -- The basic approach was to record the timber volume on land within the tributary area by summing up the inventories of the various land segments therein. The tributary area was divided into such segments as counties, national forests, or state and private ownerships.

In areas where the tributary area boundary did not coincide with the boundary of the area for which a volume figure was available, a volume proportional to the included land area was calculated. This, of course, assumes homogeneity of the land considered and constitutes a possible source of error. Forest Survey data proved to be only partially adequate for this purpose. Current timber resource information from that source is for various land areas,

with counties being the smallest subdivision. Some data are also available concerning primary processors' volumes of residues and by-products and logging residues. Available for various land areas was information regarding growing stock volumes and rough, rotten, and salvable dead volumes. Many of these latter data, however, came from inventories that were approximately twenty years old. It is also important to note that these data were developed as a part of a river basin survey. Using such data from these diverse sources, the Forest Survey Unit made inferences with regard to resource volumes within our tributary areas.

Because of the lack of data directly applicable to this study from Forest Survey, emphasis was placed on getting additional volume information from other federal sources, as well as from state and private organizations that had land in the boundary areas.

These volume and land area data tributary to each site were then summed, so that the total resource available at the site could be determined. When data covered a land area completely encompassed by the tributary boundary, the area's total volume information was used. However, in situations where a particular land ownership was bisected by the boundary, a volume proportional to the included land area was calculated, as previously noted.

In general, the approach in estimating resource volumes was to obtain the most current information from each of the cognizant land owners or managers. In the case of National Forest land there were several ways in which this was achieved. Every National Forest has a Timber Management Plan (TMP) that spells out the amount of timber that will be made available over a stated time period. At the time this study was conducted, most of the TMPs in Region 2 were under revision and had not yet been approved. Because of this, some of the area and timber volumes presented in this report are tentative and may be revised. However, it is reasonable to assume that the values obtained are relatively close. TMPs usually contained timber volume information in a form that could be utilized in this study. In Region 2, for example, each National Forest is usually inventoried at least once during a ten-year period. The most recent inventory may overlap the TMP that is still being used. In such instances the most current inventory data were in this study.

The inventory data existed in two forms, either as the compiled inventory or in the form of raw photo-point data. The compiled inventories were usually obtained directly from the particular National Forest in question, and were readily applicable to this study. However, when photo interpretation data were the only information available, it was necessary for us to perform the conversions from photo-point to volume data.

When land considered tributary to a particular site came under the jurisdiction of another federal agency, that agency was contacted. In one particular case -- the Fort Apache Indian Reservation tributary to White-river, Arizona, -- an extensive inventory of all commercial forest land was provided. Some federal agencies did not have information of this caliber. In most cases, the best available information from the "other federal" sources consisted only of total volumes of growing stock. Such limited information was, of course, poorly adapted to the taxonomical scheme developed in this study. As specified previously, however, the best available information was used in each case.

Information concerning state and private land tributary to the various sites was obtained from the State Forestry Divisions of those states in question. In most cases, information concerning private lands also came from the state's Forest Service. Several of the states, including Colorado, South Dakota, Wyoming and New Mexico had inventory information available by counties. The county information in Colorado was by far the best developed. It is presented in the form of Timber Resource Inventories (TRIs). These published reports contain area and volume data by stand-size class for each commercial forest species within a county. South Dakota also provided data that were developed into useful information. The South Dakota and Wyoming data, it should be mentioned, were based on inventories performed jointly by the U. S. Forest Service Forest Survey Unit in Ogden, Utah, and the State Agency. This brought about an overlap of inventory information in some cases. State and private information for the land in New Mexico and Arizona was not as well developed as that of their northern neighbors. However, through correspondence with state forestry agencies some volume data were obtained for state and private lands in these two states.

Published Information Sources -- Finally, numerous publications were reviewed in an attempt to answer remaining questions. This information was of greatest benefit in determining logging residue volume and standing and down dead volumes for various species types. More general information concerning different aspects of the various sites and the forest products industry were also obtained from various publications. A listing of these sources and the types of information obtained is given below.

Reference No.* and Information

2. Tons/acre of ground fuels on two lodgepole pine sites in Wyoming. Quantities were given for both before and after logging by two techniques; near complete and conventional clearcutting.

3. Technique to physically measure downed woody material.

7. Logging residue weights and volumes on 30 clearcut units in Douglas-fir forests of western Oregon and Washington. Additional information concerning volume of material left as slash is also presented.

10. Cubic feet/acre of ground material in four mature lodgepole pine stands in Wyoming.

11. Data on the amount of logging residue and mill residue that is unused in Alaska, California, Oregon and Washington.

13. An evaluation of five selected sites in West Virginia, with respect to quantity of raw materials. Economic comparisons of the five areas were also made.

14. Transportation costs for 34 logging operations in West Virginia.

17. Along with other aspects of particleboard production, discusses material supply costs of raw materials and production.

---

*See list of references at end of this chapter.

18. Combined volume of down dead and standing dead for spruce-fir type in Southern Colorado. Also determined zero value for volume/acre on down dead and standing dead ponderosa pine stand in Arizona.

19. Output of roundwood products, mill receipts of sawlogs from Arizona timberlands (National Forests) and the estimated volumes of used and unused plant residues from the lumber industry in Arizona.

21. Percentage of logging residue volumes to product volumes (log scale) for Arizona, New Mexico, Western South Dakota, Wyoming, Utah.

23. Amount and general location of mill residues for Colorado, S. E. Wyoming, and Black Hills.

25. Mean cubic foot volume/acre with standard deviation and coefficient of variation for standing and sound dead and down material on a lodgepole pine site in Montana.

4,5,6,16,22,27

Generalized view of the forest resource situation in South Dakota, Wyoming, Colorado, New Mexico and Arizona.

Mortality and Logging Residues -- Because of their uniqueness when compared to other types of volume information, special consideration had to be given mortality volumes, as well as logging and logging residue volumes. Mortality volumes generated annually on land tributary to the particular sites were obtained from the pertinent owners and/or managers of the land in question. Care was taken, where possible, to include only that mortality on land that is considered available for harvesting. In the case of the U. S. Forest Service lands, this included only the standard and special components of the commercial forest land. Otherwise, the mortality reported was that on total commercial forest land within the boundary area.

Estimates of Expected Cut -- The volume of timber that is expected to be cut from the tributary lands was developed in the following way:

On U. S. Forest Service lands, the volumes to be cut are reflected in the programmed allowable cut and the potential yield of the particular National Forest in question. By definition the programmed allowable cut is that volume

scheduled to be cut from the land, while the potential yield is a measure of that harvest over the next ten years needed to achieve the optimum sustained yield from the area. These volumes, usually found in the Timber Management Plan, did not in most cases reflect exactly what was being procured from the particular land area but were rather an approximation of what could happen. They are the best information available.

Information concerning the expected cut on other federal lands, as well as on state and private lands, was not as straightforward. In most of these areas future cut was uncertain, so where past harvest figures were available they were used to project future expectations. In all cases these projections were less than potential yield figures. When even the past volumes of timber were not known by the particular land owner or manager, the producers in the area were questioned as to how much timber they cut from the state and private forest areas. The sum of the volumes so obtained from each producer was then used to represent the boundary area's expected cut from state and private land.

After the expected cut for each tributary area was developed, it was necessary to determine the amount of logging residue that would be generated and thereby be tributary to the site. Setzer, et al. have developed logging residue factors for the five states of concern in this study. In each case, the pertinent logging residue factor was multiplied by the expected 1975 harvest from the land in question. Where these harvest volumes were known, the residue expected to be produced could be calculated.

Setzer warns against using this approach to develop hard and fast volume figures for chippable wood. However, due to the absolute lack of other information on this subject, it was deemed necessary to use this technique to obtain at least some idea of the volume generated.

Definition of Terms -- Due to the numerous sources queried for volume information, problems concerning the definition of various forestry-related terms did arise. For example, the U. S. Forest Service definition of commercial forest land includes standard, special, marginal and unregulated components. Only the first two components, standard and special, represent timberland which is considered currently harvestable. The latter terms

describe areas which for reasons of topography, timber volume, etc., cannot be harvested with existing systems for reasons of cost or possible environmental damage. Because this study is concerned with the availability of timber resources within the foreseeable future, only the standard and special land components, were considered. The timber from this land was then deemed available. But this consideration was limited only to National Forest land where information concerning these different components was available. In the case of some of the other federally owned land as well as the state and private land, a distinction between available and non-available commercial forest land could not be made. In these situations the entire commercial forest data as defined by the particular agency were presented as available. It should be kept in mind that, in all but one case study, the percent of non-National Forest land tributary to each site was very small, when compared to the percent of National Forest land. The exception was Whiteriver, Arizona, where all timber came from Fort Apache Indian Reservation.

Complications also arose where growing stock was concerned. The delineation between poletimber and sawtimber size classes ranged anywhere from 9 to 11.5 inches. This discrepancy was allowed to exist in our reporting, since in most cases only the general stand-size class designation was given, without any segregation by diameters. Many other assumptions had to be made in the compilation of forest resource volume information. The specific assumptions applicable to a particular site are enumerated in the case study developed for that site.

Processing Information -- The Directory of the Forest Products Industry was consulted and local timber management officers were queried to learn the location of local processors. As expected, the local individuals had the best information concerning those businesses in operation. The individual processors were then questioned as to the volume of primary products, by-products, and residues currently generated at their respective installations on an annual basis. Information was also received from the Forest Survey Unit concerning the volumes of by-products and residues generated in each county within the tributary areas. This information was not used, however, because of the more current data obtained by our personal contacts. It should be noted that, with respect to principal products, only primary producers were

contacted. With respect to by-products and residues, however, the volumes generated by both primary and secondary producers were taken into consideration.

Economic Considerations for Each Site

Two sources of information were used to develop the necessary economic data. Specifically, these sources were members of the local forest products industry at each site and the Region 2 and Region 3 timber management offices of the U. S. Forest Service. November of 1974 was used as the date base for analysis. Some deviation from this date was unavoidable, and these exceptions are noted in the various case studies. It should be kept in mind that at the time this study was being conducted, the lumber industry as well as other forest products industries were suffering from drastic decreases in demand for their products. According to the Wall Street Journal, housing starts during the months of November and December of 1974, dropped from an annual rate of 1 million to 800,000 units, the lowest in several years. Therefore, the data obtained from the individuals contacted represent a very depressed market condition[1/].

In order to get a good overview of specific economic characteristics for each site, it was necessary to look at the various costs and values associated with all of the timber resources, products, by-products, and residues going into and coming out of the processing sites.

The values of primary products and plant residues were based on current wholesale prices f.o.b. the mill, if available, for each product, and for each processing point. When lumber was the primary product, the average value of the mill run was used. In the case of variable-product processors, the value of the most representative item in the product mix produced by the firm was used. In addition to these values, the costs of raw materials and manufacturing costs were developed.

The raw material costs used in this study are the costs of harvesting and delivering raw materials to the processing site. They include the average

1/ According to U.S.F.S. Region 3 Appraisal Bulletin No. 11, regional average lumber prices for principal species in October 1975 ranged 19-30% higher than in November 1974.

harvesting, hauling, and handling costs for each class of material, based on the most common situations at each processing point. Since each individual sale may have particular variable road maintenance, construction, and slash disposal requirements, these associated costs were not included in the analysis. As with the product values, the manufacturing costs presented are for the average mill run in the case of lumber, and for the most representative product in the case of other product processors. These costs include only those costs incurred in the conversion of the resource to a primary product. Residues are an inevitable consequence of production of a primary product. In this sense they are produced at no cost. Their unprocessed value may be positive, negative, or zero depending on whether there are available markets or whether they must be disposed of otherwise. Their unprocessed values at the primary mill site were determined from end-product values, taking into consideration hauling and processing costs involved in their conversion to marketable products. Analyses were made of alternative means for their utilization or disposal. In some cases, exact figures were given by the producers. However, because our conversations with these individuals were not formal interviews, estimates of the costs and values associated with the process were often the only data received. Occasionally, even rough estimates were not available from these sources.

Avoiding disclosure of private sources of information was a problem at a number of the processing sites where there was only one producer of a particular product. To alleviate this problem the cost and value information from each site was combined with that of another site. The basis for combining two sites was geographic proximity, which in most cases implies similarity of species types, and some economic considerations. The sites combined for this purpose only were as follows:

1. Whitewood, South Dakota
   Newcastle, Wyoming
2. Saratoga, Wyoming
   Fort Collins, Colorado
3. Pagosa Springs, Colorado
   Montrose, Colorado
4. Española, New Mexico
   Reserve, New Mexico
5. Flagstaff, Arizona
   Whiteriver, Arizona

Economic data concerning the value of products and by-products, and the costs associated with their manufacture and procurement, were also developed from U. S. Forest Service information. Both Region 2 and Region 3 Timber Management officers were able to provide guidelines used in developing product costs and values for timber sale appraisals. In both regions, the underlying source for this information was the Title 2400 Timber Appraisal guideline. The form in which these data are presented, however, was not the same for the two regional offices. From these two sources, one can find the average selling price within the region for such major products as lumber and pulpwood, with a monthly update. Regional averages for the various harvesting costs are also available, as are methods for determining regional transportation costs. Average regional manufacturing costs were also found using the aforementioned sources. The Title 2400 guideline also includes adjustment factors that are applied to each sale. These factors adjust for such characteristics as terrain, types of road used, and other conditions applicable to a particular area. In the case of each processing site in Region 2, the set of adjustment factors associated with that site, if available, was obtained from the area Forest Service timber management officer. The adjustment factors were not used in Region 3 and consequently all of the processing sites in that region were treated equally.

Other Considerations

In order to develop, compile, and record the multi-source data that are presented for each case study, several special items were considered. First of all, some categories included in the resource classification scheme have not previously been inventoried. This fact left many gaps in the volume tables presented in the case studies. Where this occurred, the symbol "N/A" is used to signify non-available data. This is to distinguish the unavailability of volume figures from zero volumes, which are also presented.

Data were often obtained in different units of measurement. For the sake of consistency, many entries had to be converted. The conversion factors used were those recommended by the Institute of Forest Products, College of Forest Resources, University of Washington. One exception to this

was the board foot to cubic foot conversion. Because of the sizes of the material dealt with in this study, it was assumed that there are 5 board feet per cubic foot of roundwood for both sawtimber and poletimber.

Most of the data are presented in terms of thousands of units. When converting these data to thousands, rounding was done in accordance with ASTM Standard Method 29-67.

Case Studies

The analysis for each tributary area is covered in a series of case studies which make up the remaining sections of this report. The tables at the end of each case study report list the sources of information that were consulted to complete that study. The remainder of this project report will examine the use of these sources in producing information for the tributary area for each site. Only those sources that offered the best information were used. The basis for a decision to use a particular source of information is explained in each case study.

References

1. Brown, D. L., et al. 1974. Private and State Timber Resources, TRI Release #1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 & 20. Colorado State Forest Service, Colorado State University, Fort Collins.

2. Brown, J. K. 1974. Reducing Fire Potential in Lodgepole Pine by Increasing Timber Supply. U.S.D.A. Forest Service Research Note INT-181, p. 6. Intermountain Forest and Range Experiment Station, Ogden, Utah.

3. Brown, J. K. 1974. Handbook for Inventorying Downed Woody Material. (Unpublished Manuscript). p. 34. U.S.D.A. Forest Service, Intermountain Forest and Range Experiment Station, Missoula, Montana.

4. Choate, G. A. 1963. The Forests of Wyoming. USDA Forest Service Intermountain Forest and Range Experiment Station, Ogden, Utah. 47 p. USDA Forest Serv. Resource Bull. INT-2.

5. Choate, G. A. 1966. New Mexico Forest Resource. USDA Forest Service Intermountain Forest and Range Experiment Station, Ogden, Utah. 60 p. USDA Forest Serv. Resource Bull. INT-5.

6. Choate, G. A. and J. S. Spencer, Jr. 1969. Forests in South Dakota. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah. 40 p. USDA Forest Service Resource Bull. INT-8.

7. Dell, J. D. and F. R. Ward. 1971. Logging Residues on Douglas-fir Region Clearcuts - Weights and Volumes. USDA Forest Service, Res. Pap. PNW-115. 10 p. Illus. Pacific Northwest Forest & Range Experiment Station, Portland, Oregon.

8. Frayer, W. E. 1974. The Increasing Complexity of Large Forest Inventories. Journal of Forestry, Volume 79, No. 9.

9. Gardner, R. B. and D. W. Hann. 1972. Utilization of Lodgepole Pine Logging Residues in Wyoming Increases Fiber Yield. U.S.D.A. Forest Serv. Research Note INT-160, p. 6. Intermountain Forest and Range Experiment Station, Ogden, Utah.

10. Grantham, J. B., E. M. Estep, J. M. Pierovich, H. Tarkow, and T. C. Adams. 1974. Energy and Raw Material Potentials of Wood Residue in the Pacific Coast States - A Summary of a Preliminary Feasibility Investigation. U.S.D.A. Forest Service General Technical Report PNW-18. 37 p. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

11. Green, Alan W. and Theodore S. Setzer. 1974. The Rocky Mountain Timber Situation (INT-10). USDA Forest Service. Intermountain Forest and Range Exp. Sta., Ogden, Utah.

12. Hagenstein, P. R. 1964. Timber Industry Opportunities in Selected Areas of West Virginia. USDA Forest Service Research Paper NE-28. 72 p. Northeastern Forest Experiment Station, Upper Darby, PA.

13. Institute of Forest Products. 1975. Conversion Factors for Pacific Northwest Forest Products. College of Forest Resources, University of Washington, Seattle, Washington.

14. Martin, A. J. 1971. The Relative Importance of Factors that Determine Log-hauling Costs. USDA Forest Service Research Paper NE-197. Northeast Forest Experiment Station, Upper Darby, PA.

15. Miller Freeman Publications. 1975. 1974 Directory of the Forest Products Industry. Miller Freeman Publications, San Francisco, California.

16. Miller, R. H. and G. A. Choate. 1964. The Forest Resource of Colorado. USDA Forest Service. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, and Intermountain Forest and Range Experiment Station, Ogden, Utah. 55 p. USDA Forest Service Resources Bull. INT-3.

17. New Mexico State University. 1970. Economic Feasibility of a Particleboard Industry in New Mexico. New Mexico State University Ag. Experiment Station Bull. 569, Las Cruces, New Mexico.

18. Sampson, Geo. R., H. E. Worth, and D. M. Donnelly. 1974. Demonstration Test of Inwoods Pulp Chip Production in the Four Corners Region. U.S.D.A. For. Serv. Res. Pap. RM-125. 18 p. Rocky Mt. Forest and Range Exp. Sta., Fort Collins, Colorado.

19. Setzer, T. S. 1971. Estimates of Products Output and Plant Residues, Arizona. 1969. USDA Forest Service. 4 p. Intermountain Forest and Range Exp. Sta., Ogden, Utah.

20. Setzer, T. S. 1973. Logging Residue on Harvesting Operations, Western South Dakota, Wyoming, Utah, and Colorado. USDA Forest Service. 13 p. Intermountain For. and Range Exp. Sta., Ogden, Utah.

21. Setzer, T. S., A. K. Wilson, and G. A. Choate. 1970. Logging Residues on Saw Log Operations, Arizona and New Mexico - USDA Forest Service Res. Paper INT-78. 11 p. Intermountain For. and Range Exp. Sta., Ogden, Utah.

22. Spencer, J. S. 1966. Arizona's Forest, Rocky Mountain Forest and Range Exp. Sta., Ft. Collins, Colorado, and Intermountain For. and Range Exp. Sta., Ogden, Utah. 56 p. USDA Forest Service Resource Bull. INT-6.

23. USDA Forest Service. 1972. From the Fire to the Frying Pan. Rocky Mountain Region. USDA Forest Ser. 1-44 p.

24. U.S.D.A. Forest Service. 1973. The Outlook for Timber in the United States. U.S.D.A. Forest Service Resource Report No. 20. 367 p.

25. U.S.D.A. Forest Service. 1974. Wood Product Potential in Mature Lodgepole Pine Stands. Bitterroot National Forest--Interim Report. 19 p. Intermountain For. and Range Exp. Sta., Missoula, Montana.

26. Wall Street Journal. 1975. Housing Starts. The Wall Street Journal, Pacific Coast Edition, San Francisco, California. October 20, 1975. p. 1.

27. Wilson, A. K. 1964. Timber Products Output in Arizona and New Mexico, 1962. USDA Forest Service Intermountain For. and Range Exp. Sta., Ogden, Utah. 88 p. U. S. Forest Ser. Res. Paper INT-5.

Personal Correspondence

1. Bob Benson, Research Forester, Intermountain Forest and Range Experiment Station, Missoula, Montana.

2. John H. Dieterich, Project Leader, Rocky Mountain Forest and Range Experiment Station, Tempe, Arizona.

Acknowledgements

This study was initiated in June 1974 in response to a prospectus of needed research in the project area prepared by H. E. Worth of the Rocky Mountain Forest and Range Experiment Station. Mr. Worth has served as the responsible Station officer for this research project throughout the entire study. The authors acknowledge their indebtedness to him and to other members of the Rocky Mountain Station staff, including Mr. George Sampson, Mr. Donald Markstrom, and Mr. Dennis Donnelly, for their continued assistance throughout. Dr. W. E. Frayer of the Resources Evaluation Group of the U. S. Forest Service, participated in the planning phase of this study while still a member of the faculty of Colorado State University.

The invaluable cooperation of the Forest Survey Unit of the U. S. Forest Service at Ogden, Utah and particularly that of Mr. Theodore Setzer, of the Region 2 and Region 3 offices of the U. S. Forest Service, and of the offices of the Supervisors of all the national forests involved in this study must be documented. Particular personal appreciation is expressed to Messrs. Ken Kilborn (then with the Colorado State Forest Service) and Tom Loring of the U. S. Forest Service, Region 3.

Individuals representing private concerns who contributed essential processor's information are identified in the individual case study reports. The authors here express appreciation for their cooperation. Individuals representing public agencies who likewise contributed to this study include Bryan Mangum, Donald Kistler, Herb Cotrell, Tom Quinn, Dave Wright, Wallace Staples, Rod Starkey, Peter Wingle, Frank Ellison, Jim Freeman, Mark Johannesen, Stephen Healey, Charles Orvig, John Smith, Jack Utley, and Bud Mast. To them and to many other knowledgeable individuals who contributed to this research, we acknowledge our indebtedness.

The authors of this report are Terry Anderson and Gene Downey, graduate research assistants, together with their faculty advisers, Drs. Betters, Troxell, and Wangaard.

GLOSSARY

Land Use Classes

Forest land -- Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for non-forest use. (Note: Stocking is measured by comparison of basal area and/or number of trees, by age or size and spacing with specified standards. The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, or other bodies of water or clearings in forest areas shall be classed as forest if less than 120 feet in width.) Also see definitions for land area, commercial forest land, stocking, unproductive forest land, and water.

Commercial forest land -- Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. (Note: Areas qualifying as commercial forest land have the capacility of producing in excess of 20 cubic feet per acre per year of industrial wood under management. Currently inaccessible and inoperable areas are included, except when the areas involved are small and unlikely to become suitable for production of industrial wood in the foreseeable future.)

Marginal component -- A component of forest land suitable for regulated timber production but not currently available because of constraints from associated resource needs, high development costs and low product values, or absence of market for the species or product available.

Special component -- That part of the regulated forest land suitable and available for timber production which is recognized in the Multiple Use Plan as needing specially designed silvicultural treatment of the timber resource to achieve landscape or other key resource objectives.

Standard component -- The component of the regulated forest land suitable and available for timber production on which crops of industrial wood can be grown and harvested with adequate protection of the forest resources under the usual provisions of the timber sale contract.

Deferred forest land -- National Forest lands that meet productivity standards for commercial forest, but are under study for possible inclusion in the Wilderness System.

Unregulated forest land -- Portions of commercial forest land and the noncommercial forest land which will not be utilized for sustained timber production.

Noncommercial forest land -- (1) Unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions, and (2) productive-reserved forest land.

Productive-reserved forest land -- Forest land sufficiently productive to qualify as commercial forest land, but withdrawn from timber utilization through statute, administrative designation, or exclusive use for Christmas tree production.

Inaccessible -- An area of forest land suitable for timber production but not available because the cost of building access roads is expected to exceed the monetary value of the first timber harvest.

Unproductive forest land -- Forest land incapable of producing 20 cubic feet per acre of industrial wood under natural conditions, because of adverse site conditions. (Note: Adverse conditions include sterile soils, dry climate, poor drainage, high elevation, steepness, and rockiness.)

Nonforest land -- Land that has never supported forests and lands formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, power-line clearings of any width, and 1-to-40 acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide, and clearing, etc., more than 1 acre in size, to qualify as nonforest land.)

Ownership Classes

Ownership -- Property owned by one owner, regardless of the number of parcels in a specified area.

National Forest land -- Federal lands which have been legally designated as National Forest or purchase units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones Title III lands.

Bureau of Land Management lands -- Federal land administered by the Bureau of Land Management.

Indian lands -- Tribal lands held in fee by the Federal Government, but administered for Indian tribal groups and Indian trust allotments.

Miscellaneous Federal lands -- Federal lands other than National Forest lands, lands administered by the Bureau of Land Management, and Indian lands.

Other Federal lands -- Federal lands other than National Forest lands, including lands administered by the Bureau of Land Management, Bureau of Indian Affairs, and other Federal agencies.

State, County, and municipal lands -- Lands owned by States, counties, and local public agencies or municipalities, or lands leased to these governmental units for 50 years or more.

Other public -- All federal lands other than National Forest lands, and State, county, and municipal lands.

Farmer-owned lands -- Lands owned by farm operators. (Note: These exclude land leased by farm operators from nonfarm owners, such as railroad companies and States.)

Forest industry lands -- Lands owned by companies or individuals operating wood-using plants.

Forest Type and Tree Species

Forest types -- A classification of forest land based upon the species forming a plurality of live-tree stocking. (Note: Types shall be determined on the basis of species plurality of all live trees that contribute to stocking; that is, up to a maximum of 16 percent at each plot point based upon a 10-point location.)

Major forest type -- A grouping of local forest types into about 10 eastern and 10 western groups. The groupings are based upon similar and associated species.

Commercial species -- Tree species presently or prospectively suitable for industrial wood products. (Note: Excludes species of typically small size, poor form, or inferior quality, such as hawthorn and sumac, scrub willow and alder.)

Noncommercial species -- Tree species of typically small size, poor form, or inferior quality which normally do not develop into trees suitable for industrial wood products.

Softwoods -- Coniferous trees, usually evergreen having needles or scalelike leaves.

Hardwoods -- Dicotyledonous trees, usually broad-leaved and deciduous.

Class of Timber

Growing-stock trees -- Live trees of commercial species meeting specified standards of quality or vigor; excludes cull trees.

Rough trees -- (1) Live trees of commercial species that do not contain at least one 12-foot saw log or two noncontiguous saw logs each 8 feet long or longer -- now or prospectively -- and/or do not meet Regional specifications for freedom from defect primarily because of roughness or poor form; (2) all live trees of noncommercial species.

Rotten trees -- Live trees of commercial species that do not contain at least one 12-foot saw log or two noncontiguous saw logs, each 8 feet long or longer -- now or prospectively -- and/or do not meet Regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Cull -- Portions of a tree that are unusable for industrial wood products because of rot, form, or other defect.

Salvable dead trees -- Sanding or down dead trees that are considered merchantable by Regional standards.

Mortality trees -- Trees formerly growing stock dying from natural causes during a specified period, usually annually.

Diameters and Size Classes

Diameter classes -- A classification of trees based on diameter outside bark, measured at breast height (4 1/2 feet above the ground). (Note: d.b.h. is the common abbreviation for diameter at breast height. Two-inch diameter classes are commonly used in Forest Survey, with the even inch the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h. inclusive.)

Tree size class -- A classification of trees based on diameter at breast height, including sawtimber trees, poletimber trees, and saplings and seedlings.

Seedlings -- Live trees less than 1.0 inch in d.b.h.

Saplings -- Trees 1.0 to 5.0 inches in d.b.h.

Poletimber trees -- Trees at least 5.0 inches in d.b.h., but smaller than sawtimber size.

Sawtimber trees -- Trees exceeding poletimber size. In the Intermountain States, the minimum d.b.h. for softwood sawtimber is 9.0 inches, and 11.0 inches for hardwoods.

Volume

Net volume -- Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.

Growing-stock volume -- Net volume in cubic feet of live sawtimber trees and live poletimber trees from stump to a minimum 4.0 inch top (of central stem) outside bark. Net volume equals gross volume less deduction for rot and missing bole sections.

International 1/4-inch rule -- The standard board-foot log rule adopted nationally by the Forest Service for the presentation of Forest Survey volume statistics.

Growth and Mortality

Gross growth -- Annual increase in net volume of trees in the absence of cutting and mortality. Includes ingrowth and accretion.

Net annual growth -- The increase in net volume of a specified size class for a specific year. (Note: Components of net annual growth include the increment in net volume of trees at the beginning of the specific year surviving to its end, plus net volume of trees reaching the size class during the year, minus the net volume of trees that died during the year, minus the net volume of trees that became rough or rotten trees during the year.)

Ingrowth -- The number or net volume of trees that grow large enough during a specified year to qualify as saplings, poletimber, or sawtimber. The measurement is at the size of entry into the size class.

Accretion -- Annual increase in net volume of trees in a size class, and the increase in net volume of trees after reaching a measured size class during the year.

Mortality -- Number or sound-wood volume of growing stock trees dying from natural causes during a specified period.

Timber Cut

Allowable cut -- The volume of timber that could be cut on commercial forest land during a given period under specified management plans aimed at sustained production of timber products.

Timber removals -- The net volume of growing stock trees removed from the inventory by harvesting, cultural operations, such as timber-stand improvement, land clearing, or changes in land use.

Timber products -- Roundwood products and plant byproducts. (Note: Timber products output includes roundwood products cut from growing stock on commercial forest land, and from other sources, such as cull tree, salvable dead trees, limbs, and saplings, or from trees on noncommercial and nonforest lands, and from plant byproducts.)

Roundwood products -- Logs, bolts, or other round sections cut from trees for industrial or consumer uses. (Note: Includes saw logs, veneer logs and bolts, cooperage logs and bolts, pulpwood, fuelwood, piling, poles, hewn ties, mine timbers, and various other round, split, or hewn products.)

Plant residues -- Wood materials from manufacturing plants not utilized for some product. (Note: Includes slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and pulp screenings.)

Logging residues -- The unused portions of trees cut or killed by logging.

Other removals -- The net volume of growing-stock trees removed from the inventory by cultural operations, such as timber-stand improvements, land clearing, and changes in land use.

Rotation -- The period of years between establishment of a stand of timber and the time when it is considered ready for cutting and regeneration.

Quality

Industrial wood -- All roundwood products, except fuelwood.

Site

Site class -- A classification of forest land in terms of inherent capacity to grow crops of industrial wood.

Site classifications are based upon the mean annual growth of growing stock (not including thinnings) attainable in fully stocked stands at culmination of mean annual growth. Height-age relationships are usually used as indicators of the specified volume-site class.

Stand Size Classes

Stand-size class -- A classification of forest land based on the size class of growing stock trees on the area, that is, sawtimber, poletimber, or seedlings and saplings. (Note: Only those trees that contribute to no more than 16 percent stocking at a plot point, based upon a 10-point location, will be considered in determining stand-size class.)

Sawtimber stands -- a. Stands at least 16.7 percent stocked with growing stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands -- b. Stands at least 16.7 percent stocked with growing stock trees in which half or more of this stocking is a poletimber and/or sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands -- c. Stands at least 16.7 percent stocked with growing stock trees in which more than half of the stocking is saplings and/or seedlings.

Nonstocked land -- d. Commercial forest land less than 16.7 percent stocked with growing-stock trees.

CASE STUDY I: WHITEWOOD, SOUTH DAKOTA AND NEWCASTLE, WYOMING

Summary

It was found that approximately 620 MM cubic feet and 624 MM cubic feet of living material was available to Whitewood, South Dakota and Newcastle, Wyoming, respectively. An additional volume of 3.4 MM cubic feet of dead wood material is available to Whitewood, with the annual possibility of generating 7.6 MM cubic feet more through logging residues and mortality. A volume of 2.9 MM cubic feet of dead raw material was found tributary to Newcastle, with an additional volume of 4.2 MM cubic feet, per year made possible through logging residue and mortality.

With respect to consumption, it was found that 38.5 MMBF of lumber was produced annually by the firms on the two sites, as well as 3086 M cubic feet of posts and poles and 20800 cords of pulpwood. It was also learned that 36 M units of chips are produced at the two processing sites, as well as an undetermined amount of bark, shavings, and sawdust. Most of the chips were shipped to the Lake States for use in pulp and paper manufacture, while the bark, shavings, and sawdust are either used minimally as mulch or are burned. The average product values fob mill found in the area were $148.50/MBF for lumber and ties, $2510.00/M cubic feet for treated poles, $2250.00/M cubic feet for treated posts, and $27.00/cord for pulpwood. The average milling cost in the two areas was $38.50/MBF for lumber and ties, and $870.00/M cubic feet for treated material. The average raw material cost delivered millsite was $47.50/MBF for lumber, $282.30/M cubic feet of 82-inch post stock, and $15.60/cord of pulpwood.

In general, information concerning land area and volume of growing stock on commercial forest land tributary to the two sites was available and current. Volume data for rough and rotten material were available for only the national forest land and the state and private lands in Pennington county.

Information specifying the volume of standing and down dead material was not available from any of the sources contacted. However, information was found for the volume of sound dead which may include both standing and down-dead material on the national forest land considered tributary to these sites.

The amount of logging residue which could possibly be generated on an annual basis was calculated for the national forest land as well as for Lawrence County, South Dakota. Annual mortality was also available for that national forest land under consideration.

It should be noted that in order to compile the data on resources available to these two particular sites, some manipulation of available data was required. This was due to the fact that all of the information found was for a much larger land area (i.e., the Black Hills National Forest or one of the Counties). These land areas were sub-divided to develop information concerning a particular processing site. To accomplish this, an assumption of homogeneity as to land ownership, species, and stand-size class mix was made. Because of this the volume data presented may lack the precision desired.

With respect to the potential yield and the programmed allowable cut, the information required was not readily available for use in this study. This was due to the fact that the Black Hills National Forest is without a current ten-year timber management plan. This will, however, be rectified sometime in the near future.

Economic information concerning the volumes, costs, and values of primary products and by-products from the study sites was readily obtained from both the U. S. Forest Service and the local industries. The U. S. Forest Service information was used in the appraisal of timber sales to various Black Hills area processors, and is considered an average for the entire Black Hills area. Information pertinent to the study was obtained for volumes of primary products and chips, as well as the costs and values associated with the particular items in question. The volumes of sawdust and bark produced in the area could not be ascertained from the operators. This was mainly due to the fact that some of them did not keep such information. Likewise, the cost incurred in handling this residue was unknown. The authors have estimated volume based on an industry-wide average ratio. This potential source of by-products was principally being burned in teepee burners with no consideration given to volumes or costs. It was therefore assumed to have no value. This

is in contrast to chips, which had a definite market and therefore could be assigned a value as raw material for pulping at mills in the Lake States. With respect to the reliability of the data obtained from private sources -- in all cases principal individuals were contacted but only occasionally did these individuals consult past records, and the data were given as approximations.

Introduction

Whitewood, South Dakota and Newcastle, Wyoming were chosen from the Black Hills area. Whitewood is located on the northeastern edge of the Black Hills National Forest. Three forest-related industries are located in or around the town. These firms produce such products as lumber, pulpwood, and treated posts and poles. The town is within one mile of Interstate 90 and has rail service.

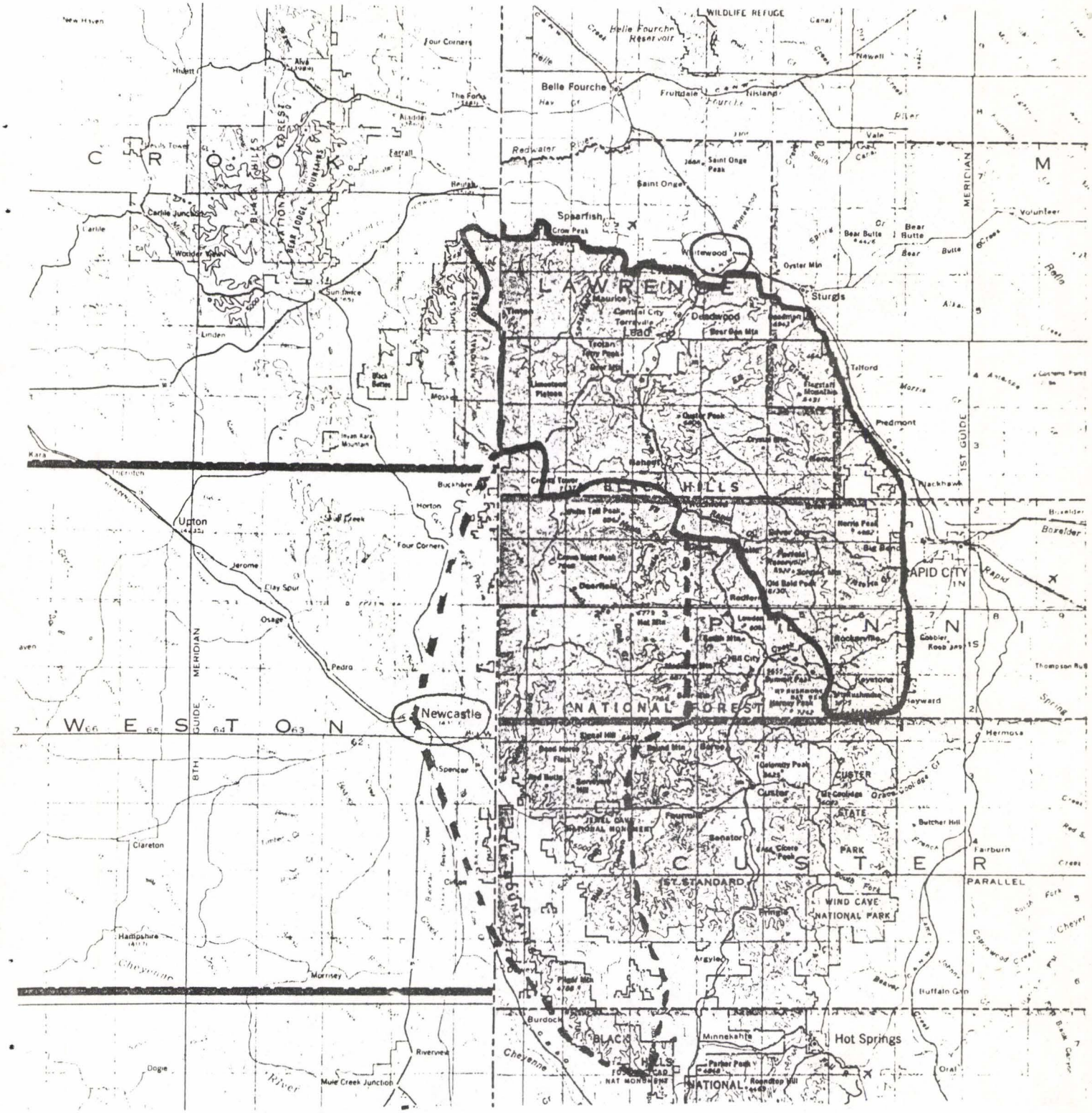
Newcastle is located on the west-central edge of the Black Hills National Forest. At the time of the study, one firm producing lumber was located within the town. This community also has access to a rail line, as well as U. S. Highways 14 and 85.

The major commercial species found in the study area are ponderosa pine and white spruce accompanied by a small amount of Douglas-fir. Some hardwoods are also available for commercial use. These include bigleaf cottonwood and quaking aspen.

The first step after the selection of Whitewood, South Dakota and Newcastle, Wyoming, was to determine the areas to be considered tributary to the sites. This was done with the cooperation of the Black Hills National Forest Supervisor's office located in Custer, S. D. Information concerning the specific ranger districts that were considered tributary to these two sites was obtained from the supervisor's office. This breakdown of National Forest land data proved extremely beneficial since information on federally-owned land by county was not available in the form required for this report. The boundaries are depicted in Figure I-1.

For purposes of general discussion the two sites in this case study have been combined. This was done because much of the timber available to both sites came from the same ownerships, although usually from different geographic locations within those ownerships. The methodology accounted for similarities on both sites -- hence the combined discussion.

Figure I-1. Areas tributary to Whitewood, SD and Newcastle, WY.


WILDLIFE REFUGE
Belle Fourche Reservoir
Belle Fourche
Redwater River
Saint Onge
Spearfish
Crow Peak
Whitewood
Sturgis
Oyster Mtn
Bear Butte
Volunteer
MERIDIAN
LAWRENCE
Maurice
Central City
Terraville
Lead
Deadwood
Bear Gulch Mtn
Trojan
Terry Peak
Telford
Thoreau
Custer Peak
Crystal Cave
Predmont
1ST GUIDE
Nemo
Nahcahpa
Crystal Tower
BLACK HILLS
Nemo
Buckhorn
Horton
Four Corners
Upton
Jerome
Clay Spur
Osage
Pedro
Newcastle
WYOMING
8TH GUIDE MERIDIAN
Spencer
Clareton
Hartspshire
Morrisey
Cheyenne River
Dogie
Riverview
Mule Creek Junction
Burdock
Argyle
Minnekahta
Hot Springs
Oral
Parker Peak
Roantop Hill
NATIONAL
Rapid City
Boxelder
Rockerville
Keystone
Hayward
Hermosa
Custer
Custer Peak
Sylvan Lake
Harney Peak
Black Elk Peak
Mt Coolidge
Butcher Hill
Fairburn
Senator
Pringle
Wind Cave National Park
Buffalo Gap
Beaver
Cheyenne
Spring
Rapid
Thompson Run
Crooks Creek
Cascade Springs
Hell Canyon
Jewel Cave National Monument
Custer State Park
1ST STANDARD PARALLEL
BLACK HILLS NATIONAL FOREST
CROOK
Four Corners
Hulett
Alva
The Forks
Aladdin
Ferrall
Devils Tower
Carlile Junction
Carlile
Warder Spgs
Sundance
Linden
Iron Kara Mountain
Kara
Interior
Black Buttes
Moskee
Bear Lodge Mountains
Bear Lodge Mountains National Forest
Belle Fourche River
Redwater River
Whitewood Creek
Spring Creek
Bear Butte Creek
Bear Butte
Alkali Creek
Rapid Creek
Boxelder Creek
Morris Creek
Elk Creek
Spring Creek
Cheyenne River
Beaver Creek
Crookwood Creek
Cheyenne
Fairburn
Hermosa
Oral
Hot Springs
Minnekahta
Burdock
Riverview
Mule Creek Junction
Dogie
Hartspshire
Morrisey
Clareton
Spencer
Newcastle
Upton
Jerome
Clay Spur
Osage
Pedro
Horton
Four Corners
Buckhorn
Interior
Kara
Linden
Carlile
Carlile Junction
Warder Spgs
Sundance
Devils Tower
Hulett
Alva
The Forks
Aladdin
Ferrall
Four Corners
New Haven
Belle Fourche Reservoir
Belle Fourche
Fruitdale
Island
Vale
Saint Onge
Saint Onge Peak
Whitewood
Sturgis
Oyster Mtn
Bear Butte
Volunteer
Maurice
Central City
Terraville
Lead
Deadwood
Bear Gulch Mtn
Trojan
Terry Peak
Telford
Thoreau
Custer Peak
Crystal Cave
Predmont
Nemo
Nahcahpa
Crystal Tower
Iron Kara Mountain
Black Buttes
Moskee
Lawrence Plateau
Thoreau
Rapid City
Boxelder
Rockerville
Keystone
Hayward
Hermosa
Custer
Custer Peak
Sylvan Lake
Harney Peak
Black Elk Peak
Mt Coolidge
Butcher Hill
Fairburn
Senator
Pringle
Wind Cave National Park
Buffalo Gap
Argyle
Beaver
Cheyenne
Spring
Rapid
Thompson Run
Crooks Creek
Cascade Springs
Hell Canyon
Jewel Cave National Monument
Custer State Park
1ST STANDARD PARALLEL
BLACK HILLS NATIONAL FOREST
1ST GUIDE MERIDIAN
8TH GUIDE MERIDIAN
W66 E65 S64T O63 N
62
7
6
5
4
3
2
1
1S
1N
7
8
9
10
11
12
13
14
15
16
17
18

Living Raw Material -- Whitewood and Newcastle

The primary data source used in developing the necessary volume and area information for the Black Hills National Forest was the 1972 Black Hills National Forest inventory. This inventory was compiled in 1975, and will be used as the basis for the next Black Hills National Forest Timber Management Plan. Information was also obtained from the Timber Evaluation and Planning Program (TEVAP2). The Black Hills National Forest Timber Management Plan was not used because its inventory base was not as current as the 1975 inventory. The 1973 Black Hills Environmental Analysis Report was also reviewed, but found to contain no timber inventory information.

With regard to state and private land area and timber volume information, 1970 inventories were available. This information was obtained from both the Intermountain Station in Ogden, Utah and the South Dakota State Forest Service, located in Rapid City. The information from both sources is based on the same inventory, and is therefore interchangeable. It should be noted, however, that the information from the two sources is organized in a slightly different form. The information from the Forest Survey Group in Ogden, Utah included timber volumes for all ownerships as of 1970. Since National Forest information current to 1972 was available, an overlap in data would have occurred. The data from the South Dakota State Forest Service dealt only with state and private ownerships. Because it could conveniently be used in conjunction with the Black Hills National Forest inventory, the South Dakota State Forest Service data were utilized. The State supplied these data for Lawrence and Pennington counties. Inventory data in the form needed for this study could not be obtained from the Wyoming State Forest Service for Weston County, Wyoming. The data obtained from the Forest Survey Unit in Ogden, Utah were therefore utilized for the county.

According to information provided by the 1973 TEVAP program obtained from the U. S. Forest Service Timber inventory group in Ft. Collins, CO., there are 1,604,396 acres within the boundaries of the Black Hills National Forest. The area figure includes both public and private ownerships, as well as

forested and non-forested land within the boundary. From the Forest Supervisor's office in Custer, S. D. it was found that Pactola, Spearfish, and Nemo Ranger Districts were tributary to Whitewood, while Elk Mountain and one-half of Harney ranger districts were tributary to Newcastle. The boundaries for these ranger districts were acquired from the Supervisor's Office of the Black Hills National Forest. To calculate the areas and volumes within the pertinent districts that were considered tributary to Whitewood, S. D. and to Newcastle, WY., the planimetered area was used as a percentage of the total land area of the national forest. Since the inventory data were presented only for the total land area of the Black Hills National Forest, this type of manipulation was deemed necessary in order to get the information in terms of our specific boundary areas. This methodology assumes that the ownership of the land as well as the distribution of species and stand-size classes is homogeneous throughout the entire area -- a possible source of error.

The planimetered areas for each ranger district are given below:

Processing Site	Ranger District	Planimetered Area (Acres)	Planimetered Area/ Total Area (%)	Sum %
Newcastle	Harney (one-half)	113587	07.0	27.7
	Elk Mountain	333312	20.7	
Whitewood	Pactola	126259	07.8	
	Spearfish	162278	10.1	32.8
	Nemo	240486	14.9	

The sums of the area percentage values, 27.7 and 32.8, were then used as a percentage of the timber volumes and land areas given in the 1972 Black Hills Inventory. The resulting inventory values are presented in Tables I-1 and I-2. It should be noted that these data reflect the volumes and areas of commercial forest land, which includes marginal as well as standard and special components.

The values for the volume of rough and rotten timber were also calculated by multiplying the pertinent ranger district percentage factors by the rough and rotten volumes for the entire forest. This cull information was also found in the 1972 Forest Inventory, and is presented in Tables I-1 and I-2.

With respect to state and private lands, 97 percent of the commercial forest land area of Lawrence County was considered tributary to Whitewood, while 3 percent was tributary to Newcastle. The reference used for these data was the Lawrence County Inventory of 1971. This information was obtained from the South Dakota State Forest Service, instead of using Forest Survey summaries because its format was more convenient for the availability study. The total land area within the county was broken down by species as follows:

63.2% ponderosa pine type
7.1% spruce type
29.7% hardwoods

These factors were multiplied by the acreage values given for each of the stand-size class values given below:

7,118 acres seedling/saplings
10,615 acres poletimber
57,820 acres sawtimber

The resulting area values are given in Tables I-1 and I-2. This procedure lso assumes that all of the commercial forest land within the county is homogeneous. This approach was necessary because specific volumes for each species, by stand-size class, were not available for the county's land area.

A similar procedure was used to develop the volume data for Lawrence County. The percent of net cubic foot volume by forest type is given below:

68.4% ponderosa pine type
10.1% spruce type
21.5% hardwoods

These factors were then multiplied by the volume data for each stand-size class as given by the Lawrence County inventory:

1,767,647 cubic feet seedlings/saplings
14,715,116 cubic feet poletimber
94,921,051 cubic feet sawtimber

The resulting volumes are given in Tables I-1 and I-2. No information regarding the volume of rough and rotten timber on state and private land within Lawrence was available at the time of this study.

For Pennington County, South Dakota, the total volumes for ponderosa pine type, spruce type and hardwoods which were tributary to Newcastle, Wyoming, were given by the State Forest Service Inventory of 1971. Again, the assumption of homogeneity was necessary due to the format of the data. The percentages of each species by volume are given below:

97% ponderosa pine type
2% spruce type
1% hardwoods

These factors were then multiplied by the following forest land areas:

4,039 acres seedlings/saplings
16,900 acres poletimber
20,515 acres sawtimber

The same species percentage factors were used to find the volumes by species and stand-size class of softwoods. The volume figures which were multiplied by the above percentage values are given below:

17,305 M cubic feet poletimber
30,268 M cubic feet sawtimber

The volumes of hardwood pole and sawtimber were obtained from information supplied by the Intermountain Station in Ogden, Utah. The specific source was the 1973 inventory of Pennington County, South Dakota. The data used here refer to all of the commercial forest land within the county that is west of the 103rd meridian. For the rough and rotten category in Pennington County, only total volume was available. No separation of softwood from hardwood was available.

The information for Weston County's state and private lands was obtained from the U. S. Forest Survey Unit. The volumes for sawtimber and poletimber for each species were obtained directly from the data sheet provided by Forest Survey. In the case of sawtimber, 94.2 percent of the timber was not on U. S.

Forest Service land, and 98 percent of the poletimber was not on Forest Service land. These percentages were multiplied by the volumes within the county to determine the quantity of timber on state and private land. It was assumed that all of the commercial forest land in Weston County was tributary to Newcastle. In this particular case, there was no volume given for the amount of seedlings and saplings in the county. With respect to the area figures, only the total acreages for each stand-size class were given. No information was found regarding the amount of rough and rotten material on the state and private land within Weston County. No distinction was made concerning what portion of the commercial forest land within the various counties was available. It was therefore assumed that all of the commercial forest could be utilized.

Dead Raw Material -- Whitewood and Newcastle

With respect to the Black Hills National Forest land, the only values available concerning dead wood material were the gross cubic foot volumes of sound dead material in the 1972 Forest Inventory. This assumes inclusion of both standing and down dead material. Since these two volumes were inseparable from the total figure, the total sound dead volume for the various ranger districts was presented. These volumes were obtained by multiplying the acreage percentage values obtained for each ranger district by the total gross volume of sound dead material. The resulting values are presented in Tables I-3 and I-4. Sound dead information was given for the entire national forest. Therefore, by using the percentage adjustment factors, a uniform distribution of commercially available[1/] sound dead material throughout the Black Hills was assumed. Volumes of dead material on state and private land within the tributary areas could not be obtained from the sources queried.

In order to calculate the amount of logging residue to be generated annually in the area considered tributary to both sites, the annual programmed allowable cut (for 1975) for each ranger district was multiplied by the logging residue factor given by Setzer (1973). He states that for western South Dakota the net volume of logging residue from sawlog operations is 4.7 percent of the saw logs harvested. In order to obtain the amount of timber to be harvested

1/ Sound dead volume was inventoried on commercial forest land.

the programmed allowable cut figures for 1975 from Tables I-5 and I-6 were used for each ranger district. This value is the closest approximation of what will actually be cut in the area in question. The logging residue volume is presented in Tables I-3 and I-4.

The expected harvest for state and private land in Lawrence County was also multiplied by the residue factor of .047 (Setzer). Three percent of this residue volume was considered tributary to Newcastle, with the remainder going to Whitewood. The amount of logging residue for the counties is shown in Tables I-3 and I-4. No harvesting information was available for state and private lands in Pennington and Weston Counties.

The expected annual mortality for the entire Black Hills National Forest was given in the 1972 Forest Inventory. The land area percentage values for each ranger district were multiplied by the total expected mortality within each species. The resulting expected mortality in those ranger districts considered tributary to Whitewood and Newcastle is given in Tables I-3 and I-4.

Potential Yield and Annual Programmed Allowable Cut

Unlike the timber management plans (TMP) used in developing data for other sites, the Environmental Impact Statement (EIS) for the Black Hills N. F. has no 10-year potential yield tables at this time. When the TMP is developed this information should be available. The figures for potential yield in Tables I-5 and I-6 were obtained from the EIS. However, these data are only for an annual potential yield and not for a 10-year period.

The areas and volumes for annual potential yield were multiplied by the percentage adjustment factors that were used for each district on the Black Hills N. F. By using district adjustment factors we feel that we have better future yield information than if we had used a boundary adjustment factor for the entire tributary area.

The EIS information is not the final cut figure. Environmental Impact Statements are only a preliminary TMP proposal. At the time, however, it was the best available information source for the Black Hills N. F. The potential yield data were given by standard and special components in the EIS.

The procedure used to determine allowable cut on the two Black Hills sites was different than that used on the other sites in this study. There were several reasons for the different procedures. In the EIS there were annual cut and sell figures for 1974-1976 on the entire Black Hills N. F. The cut figure for the national forest could have been prorated using the adjustment factor for each district. However, from the Forest Supervisor's office on the Black Hills we were given the projected annual sell figures, by district, for 1976-1980. The sell figure is usually slightly higher than the amount of timber actually cut.

The EIS did not list sell figures by district for 1975. For the 1974-1976 period a total of 493 MMBF is to be sold according to the EIS and for 1977-1979 the sell will be 568 MMBF. Also for the 1977-79 period we know what will be sold on each district. By using a simple proportion we can approximate the 3-year sell, by district, for the 1974-76 period. A division by 3 of the 3-year sell figure yields a rough estimate of the 1975 sale on each district. For example, 79 MMBF are to be sold on a particular district from 1977-1979. Thus,

$$\frac{568}{79} = \frac{493}{X}$$

X = 68.56 MMBF Estimate of 1974-1976 district sell.

$$\frac{68.56 \text{ MMBF}}{3 \text{ yrs.}} = 22.85 \text{ MMBF/yr. district annual sale.}$$

$$\frac{22.85}{5 \text{ BF/CF}} = 4570 \text{ MCF for the district.}$$

This methodology takes into consideration that different volumes will be cut from each of the ranger districts. The programmed allowable cut and potential yield are presented in Tables I-5 and I-6.

Primary Wood Processors' Information

The combined production information was obtained from the operations that were actively producing at the time of inquiry. Included in the study of Whitewood, S. D. are the following companies: Garhart and Poole, Whitewood Post and Pole, and Wheeler Lumber Company. In Newcastle, WY. only Cambria Forest Industries was contacted. These companies were denoted as the only companies operating in the particular areas by the Black Hills Forest Supervisor's office, and were therefore selected. Physical information such as volume of output, as well as such economic information as costs of production and product value was collected. The reference time of this analysis was November, 1974. In one case, however, the best available economic information was for the third quarter of 1974. This information is outlined in Table I-7.

In the case of primary product volume and residue and by-product volume, in Table I-7 a total is given for the two areas involved. The values are the summations of all information given by the various producers. When lumber is being considered, average values and costs are representative of the mill run. With respect to the amount of sawdust and bark produced, none of the operators was able to quantify the amount generated. For economic information, the various costs and values given by the individual producers were averaged. Again, little information was available on costs and values associated with bark and sawdust. In all cases, it was assumed that the costs associated with handling these items were absorbed by factory overhead.

In addition to information obtained from individual operators, economic data were also obtained from the U. S. Forest Service timber appraisal manual, Title 2400. The techniques used were similar to those used by the Forest Service in making timber contract appraisals. In order to obtain the November selling value of lumber in the Black Hills, the 4th Quarter 1974 Index was used. This index is a quarterly supplement to the Title 2400 handbook. The resulting average selling values during that quarter for spruce and ponderosa pine are given in Table I-8. The selling value of chips and by-products was obtained directly from the Title 2400 handbook. It is also shown in Table I-8. Manufacturing costs considered applicable to the Black Hills were obtained directly

from the Title 2400 handbook. These costs included those incurred in manufacturing lumber, chips, and by-products. These costs are shown in Table I-8. The cost and values associated with chips and by-products are those which are realized when one thousand board feet, log scale (L.S.) are processed.

The basic costs of felling and bucking, skidding, loading and overhead for the Black Hills area were also obtained directly from the Title 2400 handbook. Logging costs are available for the raw materials of both sawtimber and roundwood products. These costs are given in Table I-8.

The hauling costs were developed using cost factors developed in the Title 2400 handbook. The calculations were based on an average round trip haul of 90 miles, with two trips possible within a single working day. The resulting haul cost using these parameters is given in Table I-7. The timber management group suggested 90 miles as an average round trip for the two sites.

The values and costs given to us by the producers are summarized in Table I-9. For lumber and pulpwood, the procedure was straightforward. With posts and poles some difficulty did arise, however, since the value and milling costs were given in terms of cubic feet of treated material while the raw material cost to the mill was given in terms of pieces for poles and cords for posts. A cubic foot cost was therefore developed for these two items. Smalian's formula was used to find the cubic foot volume of the average pole under consideration. The cost per thousand cubic feet was then developed from the cost of the average cubic foot volume of the pole. The cost per thousand cubic feet of post material was developed by assuming 85 cu. ft. per cord[1/] This volume and the associated cost were then applied to 1000 cubic feet to determine the costs given in Table I-9.

1/ From Conversion Factors for Pacific Northwest Forest Products, University of Washington, Seattle, Washington.

References

1. Choate, G. A. and J. S. Spencer, Jr. 1969. Forests in South Dakota. U.S.D.A. Forest Service Intermountain Forest and Range Exp. Sta., Ogden, Utah.

2. Myers, C. A. 1973. Computerized Preparation of Timber Management Plans: TEVAP 2. U.S.D.A. Forest Service. Research Paper RM 115, 72 p.

3. Setzer, T. A. 1973. Logging Residues on Harvesting Operations, Western South Dakota, Wyoming, Utah and Colorado. Intermountain Forest and Range Exp. Sta., No. 135. Ogden, Utah.

4. South Dakota State Forest Service. 1970. Inventory of Pennington and Lawrence Counties, State and Privately Owned Land.

5. Timber Evaluation and Planning Program (TEVAP 2) 1974. Black Hills Run.

6. U.S.D.A. Forest Service. 1973. Environmental Analysis Report. Black Hills Working Circle: FY1974 through 1976 Management Plan Amendment. Black Hills National Forest.

7. U.S.D.A. Forest Service. 1975. Commercial Forest Inventory of Land Tributary to Whitewood, S. D. and Newcastle, Wyoming as of 1970: As compiled by the Forest Survey Unit, Intermountain Forest and Range Exp. Sta., Ogden, Utah.

8. U.S.D.A. Forest Service. 1972 Black Hills National Forest Inventory.

Agencies Contacted for Information

1. Forest Survey Unit, U.S.D.A. Forest Service, Intermountain Station, Ogden, Utah.

2. South Dakota State Forest Service, Rapid City, South Dakota.

3. Supervisor's Office, Black Hills National Forest, Custer, South Dakota.

4. Timber Inventory Unit, U.S.D.A. Forest Service, Ft. Collins, Colorado.

5. Wyoming State Forest Service, Cheyenne, Wyoming.

Individuals Contacted for Information

1. Mr. John Garhart, Garhart and Poole, Whitewood, S. D.

2. Mr. Jerry Westburg, Whitewood Post and Pole, Whitewood, S. D.

3. Mr. Dean Herman and Mr. Jack Bradt, Wheeler Lumber, Whitewood, S. D.

4. Mr. Pete Fields, Cambria Lumber Co., Newcastle, WY.

TABLE I-1. Living Raw Material Tributary to Whitewood, South Dakota

Geographic Location / Information Source	Black Hills Nat'l Forest 1975 Timber Inventory		Lawrence County 1971 Timber Inventory		Total of Table I-1 of Living Mtl.	
	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber						
Spruce-fir type	6,817	14,030	3,982	9,299		
Ponderosa pine	220,909	390,236	35,446	62,978		
Hardwoods	2,402	3,232	16,659	19,796		
Total Sawtimber	230,128	407,498	56,087	92,073	286,215	499,571
Poletimber						
Spruce-fir type	0	0	731	1,412		
Ponderosa pine	78,414	94,941	6,508	9,564		
Hardwoods	948	431	3,057	301		
Total Poletimber	79,362	95,372	10,296	11,277	89,658	106,649
Seedlings/saplings						
Spruce-fir type	0	0	490	173		
Ponderosa pine	8,077	1,979	4,364	1,173		
Hardwoods	0	0	2,051	369		
Total Seedlings/Saplings	8,077	1,979	6,905	1,715	14,982	3,694
Rough						
Softwoods		3,769				
Hardwoods		4,205				
Total Rough	N/A	7,974	N/A	N/A	N/A	7,974
Rotten						
Softwoods		769				
Hardwoods		1,418				
Total Rotten	N/A	2,187	N/A	N/A	N/A	2,187

Note: "N/A" signifies that certain information was not available at the time of this study.

TABLE I-2. Living Raw Material Tributary to Newcastle, Wyoming

Geographic Location / Information Source	Black Hills Nat'l For. 1975 Timber Inventory		Pennington County Timber Inventory73 [1]		Weston County INT - Ogden		Lawrence County 1971 Timber Inv.		Total of Table I-2 Living Mtl.	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber										
Spruce-fir	5,768	11,870	423	600		1,411	123	288		
Ponderosa pine	186,896	330,154	20,515	29,424		87,908	1,096	1,948		
Hardwoods	2,666	2,734	212	243		6,075	515	612		
Total Sawtimber	195,330	344,758	21,150	30,267	66,000	95,394	1,734	2,848	284,214	473,267
Poletimber										
Spruce-fir	0	0	338	349		795	23	44		
Ponderosa Pine	66,341	80,324	16,393	17,117		32,125	201	296		
Hardwoods	802	364	169	229		7,694	95	9		
Total Poletimber	67,143	80,688	16,900	17,695	64,000	40,614	319	349	148,362	139,346
Seedlings & Saplings										
Spruce-fir	0	0	81				15	3		
Ponderosa pine	6,833	1,674	3,918				135	39		
Hardwoods	0	0	40				63	11		
Total Seedlings & Saplings	6,833	1,674	4,039	N/A	1,000	N/A	213	53	12,085	1,727
Rough										
Softwoods		3,189								
Hardwoods		3,558								
Total Rough	N/A	6,747	N/A	539	N/A	N/A	N/A	N/A	N/A	7,286
Rotten										
Softwoods		651								
Hardwoods		1,200								
Total Rotten	N/A	1,851	N/A	108	N/A	N/A	N/A	N/A	N/A	1,959

[1] Total for S&P land in Pennington County West of 103 meridian.

Note: "N/A" signifies that certain information was not available at the time of this study.

TABLE I-3. Dead Raw Material Tributary to Whitewood, South Dakota

Geographic Location	Ranger Districts			State and Private
	Pactola	Spearfish	Nemo	Lawrence County
	MCF	MCF	MCF	MCF
Salvable Dead Standing Material				
Ponderosa type				
Spruce				
Total Standing Dead	N/A	N/A	N/A	N/A
Down Material				
Ponderosa type				
Spruce				
Total Down	N/A	N/A	N/A	N/A
Total Sound Dead[1/]	813	1,053	1,554	N/A
Logging Residue/yr				
Ponderosa				
Spruce				
Total Logging Res /yr	128	240	235	243
Mortality/Yr				
Ponderosa	1,144	1,481	2,185	N/A
Spruce	468	606	894	
Total Mortality/yr	1,612	2,087	3,079	N/A

1/ Based on total gross volume of sound dead mat'l 1975 Timber Inventory

Note: "N/A" signifies that certain information was not available at the time of this study. In some cases, total information was available, but individual data were not.

TABLE I-4. Dead Raw Material Tributary to Newcastle, Wyoming

Geographic Location	Ranger Districts		State and Private
	Harney 1/	Elk Mountain	Lawrence County
	MCF	MCF	MCF
Salvable Dead Standing Material			
Ponderosa			
Spruce			
Total Standing Dead	N/A	N/A	N/A
Down Material			
Ponderosa			
Spruce			
Total Down	N/A	N/A	N/A
Total Sound Dead	735	2,158	N/A
Logging Residue/Yr			
Ponderosa			
Spruce			
Total Logging Res./Yr	142	236	8
Mortality/Yr			
Ponderosa	1,034	1,144	N/A
Spruce	423	1,242	
Total Mortality/Yr	1,457	2,386	N/A

1/ Only 1/2 of Harney in the boundary

Note: "N/A" signifies that certain information was not available at the time of this study. In some cases total information was available, but individual data were not.

TABLE I-5. Potential Yield and Programmed Allowable Cut for Newcastle, Wyoming

Geographic Location	Potential Yield & Programmed Allowable Cut					
	Ranger Districts				State & Private 1/	
	Harney		Elk Mountain			
	Acres	MCF	Acres	MCF	Acres	MCF
Annual Potential Yield						
Standard:						
Sawtimber	N/A	2,583	N/A	7,527		
Roundwood	N/A	724	N/A	2,111		
Subtotal	3,727	3,307	10,868	9,638	N/A	N/A
Special:						
Sawtimber	N/A	287	N/A	836		
Roundwood	N/A	81	N/A	236		
Subtotal	411	367	1,201	1,072	N/A	N/A
Total	4,138	3,674	12,069	10,710	N/A	N/A
Programmed Annual Cut						
Standard		N/A		N/A		
Special		N/A		N/A		
Total	N/A	3,009	N/A	5,000	N/A	640

1/ Based on past industry cuts

Note: "N/A" signifies that certain information was not available at the time of this study. In some cases total information was available, but individual data were not.

TABLE I-6. Potential Yield and Programmed Allowable Cut for Whitewood, South Dakota

Geographic Location	Ranger Districts						State & Private		Other	
	Pactola		Spearfish		Nemo		Lawrence Co.		State & Private	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Annual Potential Yield										
Standard:										
Sawtimber	N/A	2,837	N/A	3,674	N/A	5,421	N/A	N/A		
Roundwood	N/A	795	N/A	1,030	N/A	1,520	N/A	N/A		
Sub total	4,095	3,632	5,302	4,704	7,822	6,941	3,425	2,825 1/	N/A	N/A
Special:										
Sawtimber	N/A	315	N/A	408	N/A	602				
Roundwood	N/A	89	N/A	115	N/A	170				
Sub total	452	404	586	523	864	772	N/A	N/A	N/A	N/A
Total	4,547	4,036	5,888	5,227	8,686	7,713	3,425	2,825	N/A	N/A
Programmed Annual Cut										
Standard		N/A		N/A		N/A				
Special		N/A		N/A		N/A				
Total	N/A	2,720	N/A	5,092	N/A	4,976	N/A	N/A	N/A	1,298

1/ 1st 5 years 3450 acres and 2850 MCF; 2nd 5 years 3400 acres and 2800 MCF according to S. D. State Forestry Office

2/ Based on past industry cuts

Note: "N/A" signifies that certain information was not available at the time of this study. In some cases total information was available, but individual data were not.

TABLE I-7. Combined Production Information for Whitewood, South Dakota and Newcastle, Wyoming as of November, 1974

Primary Product Output Volume (Annual)	25.5 MMBF (Lumber) 13.0 MMBF (Cants) 3,086 M cuft (Posts and Poles) 20,800 Cords (Pulpwood)
Avg. Value of Product FOB Mill	$148.50 MBF (Lumber & Ties) 1/ 2510.00/M cuft (treated pole) 2250.00/M cuft (treated post) 27.00/cord (Pulpwood)
Avg. Milling Costs per Unit	$38.50/MBF (Lumber & ties) 870.00/M cuft (treated material)
Avg. Raw material costs to the mill	$47.50/MBF (lumber) 282.30/MCF (82" posts) 15.60/cord (pulpwood)
Manufacturing Residue Volume (annual)	36M units (chips) The total amt. of sawdust and bark was not determined. Authors estimate 14 M units based on 0.4 unit/M bd. ft. sawn product.
Uses of Residues	Chips to pulp mills in Lake States Bark and sawdust are sold as mulch - a small percent. Most is burned in teepee burner.
Avg. Costs Associated with Residue and By-products	$5/unit chips Cost of sawdust and bark in all cases was absorbed into overhead and was therefore undeterminable.
Avg. Value of Residue and By-products FOB the Mill (value at destination less shipping cost)	$21/unit chips No values were obtained for bark and sawdust; mostly disposed of by burning. 2/
Species	98% ponderosa pine 2% spruce

1/ Average lumber value includes information from third quarter, 1974 for one industry source

2/ Compared with coal -- an unregulated energy source as to price -- on the basis of equivalent thermal content and with coal valued at $0.69/MM BTU, hogged residue fuel would be valued at $9.42/unit.

TABLE I-8. U.S. Forest Service Estimates of Production Information for the Black Hills N F portion of Region 2

Using Timber Appraisal Handbook, Title 2400.

Product Value (Periodic amendment to Title 2400)	Lumber:	$125.65/MBF Ponderosa Pine 182.39/MBF Spruce
Milling Costs	Lumber:	69.29/MBF
	Roundwood:	22.77/MBF
Raw Material Costs to the Mill	Sawlogs:	10.23 Fell & Buck 12.26 Skid 2.62 Load 5.99 Overhead 31.10/MBF
	Roundwood product:	6.23 Fell & Buck 10.37 Skid 1.60 Load 3.01 Overhead 21.21/cord
	Haul Cost:	21.05/MBF
	Note:	Haul cost based on a round trip of 90 miles, with 2 trips possible per day.
Costs associated w/residue 1/		$7.46/unit L.S. chips 1.06/unit L.S. by-products
Value of residue 1/		11.16/unit L.S. chips 1.38/unit L.S. by-products

1/ Cost or value associated with the number of units generated in processing 1 M bd. ft. log scale.

TABLE I-9. Average Product Costs and Values for Whitewood, South Dakota & Newcastle, Wyoming

Primary Product	Lumber (MBF)	Poles (MCF)	Posts (MCF)	Pulpwood (cord)
Value	$148.50	$2,510.00	$2,250.00	$27.00
Raw Material Cost at Mill	(47.50)	(276.00)	(282.30)	(15.60)
Milling Cost	(38.50)	(870.00)	(870.00)	-

Chips were quoted as having an average value of $21.00/unit, with an average production cost of $5.00/unit.

CASE STUDY II: SARATOGA, WYOMING AND FORT COLLINS, COLORADO

Summary

The Fort Collins site has 771,740 MCF of living raw material in the boundary. For Saratoga's boundary area 377,870 MCF of living material was found to be currently available. Acreages and volumes of live material were readily available. The timber management plans for the national forests proved to have the most reliable data in many cases. The investigators were somewhat hindered, however, by the various states of TMP revision. Also the lack of consistency of information contained in the TMPs made compilation difficult. Acreages and volumes of state and private lands are best developed in Colorado. Wyoming state and private data were taken from the Intermountain Station sources but were also available from the State Forester in Wyoming.

The state and private information which is presented in Table II-1 is more reliable than the same information in other states. Only Jefferson County figures had to be prorated into the boundary. The Wyoming county figures (Tables II-1 and 2) on the other hand were taken from a much older survey. The state and private figures for both Colorado and Wyoming are for CFL and do not reflect Standard and Special components.

Data from the TMPs varies in its reliability. The Arapaho and Roosevelt NF's data were not prorated by boundary adjustment factors. The Medicine Bow and Routt NF's were prorated by boundary adjustment factors. Availability factors were used to prorate the data for each national forest except the Arapaho. Therefore the reliability of the figures is presumably less for the Medicine Bow and Routt NFs.

Total standing dead was projected to be 41,840 MCF for the Fort Collins site and 18,250 for the Saratoga site. The standing dead fitures for counties were projected using the RM-125 figures of 831 cu.ft./acre of standing and down dead spruce-fir. That this figure applies in the Fort Collins or Saratoga sites is doubtful. Standing dead figures for the national forests were estimated for each forest by the Forest Service and are likely to be more accurate.

Down dead figures were 176,630 MCF for Fort Collins boundary area and 95,720 MCF for Saratoga. These figures represent only the lodgepole pine down dead material. Since these data were derived from the 825 cu.ft./acre of lodgepole pine down dead material found in Wyoming (INT-181), the reliability of these figures may be questioned.

Logging residues of 1,318 MCF were determined for the Fort Collins site and 362 MCF for Saratoga. If the projected annual cuts for 1975 in Tables II-5 and 6 are met, and the logging residues generated are accurately given in INT-135, then these residue figures should be reliable.

Total annual mortality was found only for the national forests. These figures were 9,246 MCF for Fort Collins and 1,489 MCF for Saratoga. Each national forest estimates its annual mortality and from this information standard and special component volumes were prorated into both of the two boundaries. Thus, by prorating, the reliability of the estimates is reduced.

For both Saratoga and Fort Collins, the total input volume into the mills was 33.75 MMBF for lumber and 2984 cords of post and pole material. The managers and/or owners of the wood-using industries at each site related this information in personal conversation. They also estimated that 27,300 units/year of chips were produced and 23,750 units/year of bark, shavings, etc. Not all the managers visited, however, were able to supply manufacturing residue volume data.

Average production costs and product values were also gathered. Production costs, including costs to the mill and manufacturing costs, were an average of $120/MBF for lumber and $134.88/cord for posts and poles. The average product value fob mill for lumber was $115/MBF for the two sites and $175.94/cord for posts and poles.

Production volumes, costs, and values were readily available from the local operators at each site. Average Forest Service estimates for these values are also given for comparison. The Intermountain Station also has estimates of product and by-product volumes for each county represented in the two boundary areas, but it was felt that the data collected in this study were the best available. Raw material costs to the mill are, of course, an average since each sale would have its own costs but these figures are intended to represent the site in general.

The Forest Service projects future cuts. These figures prorated into our boundary areas show the acreages and volumes that are considered to be currently available. Future harvests on state and private lands were estimated from past cuts. This is the best available estimate of future cuts from this ownership sector.

Introduction

This report examines the total wood raw material available to Saratoga, Wyoming and Fort Collins, Colorado. Hopefully, aggregating these two sites will not seriously affect the utility of the data due to the site proximity.

The boundary of the Fort Collins site is depicted on the enclosed map, Figure II-1. In the confines of this area are the Roosevelt National Forest and portions of the Arapaho and Medicine Bow National Forests as well as state and private land. The boundary was drawn with the aid of the Timber Management Office on the Roosevelt NF. Fort Collins has rail service from the Burlington Northern and Union Pacific. Major highways are U.S. 287, Colorado 14, and Interstate 25.

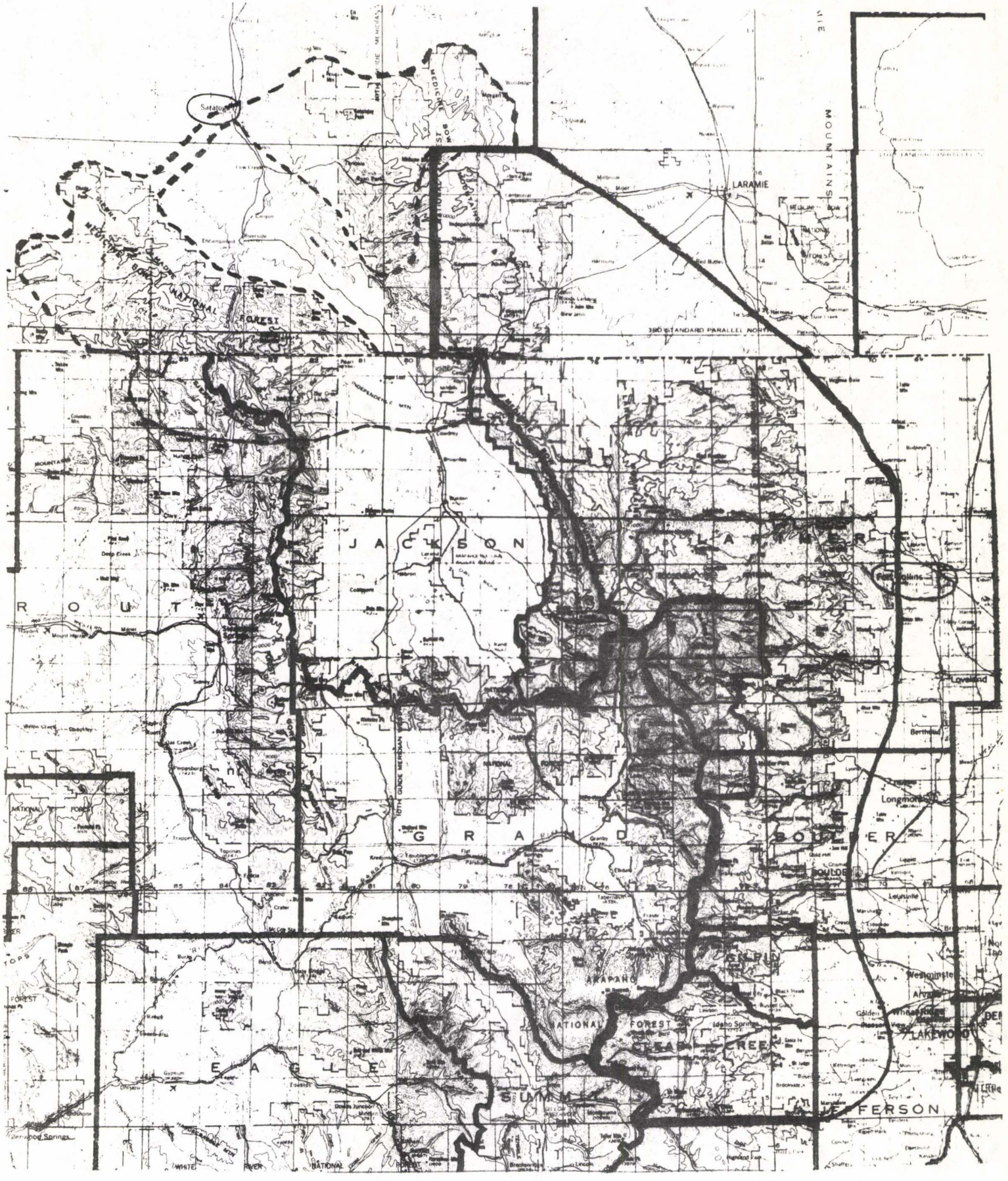
The boundary area for Saratoga, Figure II-2, was circumscribed with assistance from the Timber Management Offices of both the Routt and Medicine Bow National Forests. Portions of both of these forests as well as state and private land are tributary to Saratoga. The Union Pacific Railroad has a line through Saratoga. Highway traffic is accommodated by State Highway 130.

Four major species types are of commercial importance to the two sites. These are spruce-fir, Douglas-fir, lodgepole pine, and ponderosa pine. In order to present a more complete picture of the timber available to each site, some aspen data have also been included. However, aspen is not considered commercially important to the two sites involved.

In this case study two adjustment factors were used to find available areas and volumes of timber in the boundaries. First was a boundary adjustment factor. This factor was developed by planimetering the portion of our boundary within an ownership's land. For example, only 0.054 of the Routt NF was in our boundary. This figure was used to adjust all areas and volumes of the Routt into our boundary.

The second adjustment factor was an availability adjustment factor. The standard and special component land areas are those that are considered currently available for harvest on national forest land. These two components, are a percentage of either the total net national forest area or the commercial forest land on the national forest. This percentage, or availability factor, is used to adjust national forest areas and volumes so that they represent only standard and special components. For example, 0.55 of the commercial forest land on the Routt is classified as standard or special. Routt NF acreages and volumes multiplied by 0.054 and by 0.55 yield the area and volume, respectively, that is currently

Figure II-1. Areas tributary to Fort Collins, CO and Saratoga, WY.


Saratoga
LARAMIE
MOUNTAINS
MEDICINE BOW NATIONAL FOREST
380 STANDARD PARALLEL NORTH
JACKSON
LARIMER
ROUTT
Fort Collins
Loveland
Berthoud
Longmont
BOULDER
GRAND
SOUTH PARK
ARAPAHO NATIONAL FOREST
Idaho Springs
CLEAR CREEK
Golden
Wheat Ridge
LAKEWOOD
Westminster
EAGLE
SUMMIT
JEFFERSON
Glenwood Springs
WHITE RIVER NATIONAL FOREST
6TH GUIDE MERIDIAN

available in the boundary. National forests and state and private lands were prorated by these factors, when necessary, to show the acreages and volumes currently available in the boundary.

Living Raw Material

This section will interpret the area and volume information found in Tables II-1 and II-2. Since the area and volume information was not aggregated for the two sites, tributary data for each are presented separately.

Fort Collins

All of the information for the Fort Collins site applies to the area within its boundary limits. Where a county or national forest was not entirely in the boundary an adjustment factor based on the proportion of land in the boundary was used. This boundary adjustment factor was used to adjust areas and volumes of timbered lands whose ownership was not entirely within the boundary. By using this prorated portion of each ownership's information, an assumption is made that species and stand-size class are equally distributed throughout the land unit.

It was not necessary to use a boundary adjustment factor for living material on the Araphao NF. Ranger district acreages of standard and special components, by species type and stand-size class, were given in the preliminary Timber Management Plan (TMP). The entire Clear Creek ranger district was in the boundary. With this information we determined the acreages that were economically available to Fort Collins from the Araphao NF. An estimation of board feet per acre for each species type was also given in the TMP. This information multiplied by the acreage data estimated the currently available volumes of live timber without using any adjustment factors to prorate the data.

The entire Roosevelt NF was in our boundary so no boundary adjustment factor was necessary. The 1962 TMP was the only TMP available for the Roosevelt NF. The Timber Management Office suggested reducing areas and volumes in this plan by multiplying by 0.8173 to reflect area changes within the forest. Although the new TMP is not available, an extension of the 1962 plan has been developed. From this plan the old TMP, currently available areas and volumes of live material were estimated using the availability adjustment for the Roosevelt NF.

Not all of the Medicine Bow NF is included in our boundary. Therefore, we used a boundary adjustment factor to determine area and volume figures within our boundary. No availability factor was necessary because standard and special component acreages by species were in the TMP. This adjustment factor was used to determine the acreages for spruce-fir and lodgepole pine. These are the only commercial species considered in that forest.

Volumes in the Medicine Bow NF were given as softwood and hardwood growing stock in the preliminary TMP. Since growing stock volumes are for the entire national forest, an availability adjustment factor reflecting the percent of the standard and special component volumes for the forest was used. The boundary and availability adjustment factors determined the standard and special volumes in the Medicine Bow segment of the Fort Collins tributary area. Volumes of hardwoods, primarily aspen, were not considered because their acreages are in the unregulated component.

A small part of the Routt NF is within the boundary tributary to Fort Collins. The preliminary TMP for the Routt NF was the best source from which to gather acreage and volume data. The acreage information was prorated with the two adjustment factors to reflect the area of standard and special components in our boundary. Volume figures were given only for growing stock. The volumes were adjusted by boundary and availability factors to show volumes considered currently available.

The adjustment factors used for both the Medicine Bow and Routt National Forests assume uniform dispersion of standard and special components throughout the forest. This is the best information available for estimating available volumes and acreages.

The preceding national forest information was taken solely from the TMPs for each forest. This information was found to be the most precise data available for these forests. Information from The Forest Resource of Colorado (INT-3), and county data from the Forest Survey, Intermountain Station were also consulted for any possible insights. The estimates in these two reports were on too grand a scale, however, and too out-dated to use in this report. The data in the TMPs came closest to representing the currently available raw materials in the boundary area.

State and private information for living material was available in the Timber Resource Inventories (TRI) for Colorado counties. The areas and volumes

of commercial forest land in counties tributary to Fort Collins, except Jefferson County, were used in their entirety. Larimer County data in TRI No. 1 did not list volumes by species and stand-size class. These values were estimated from cubic feet/acre values implied in the TRI. The Jefferson County data were prorated using a boundary adjustment factor, assuming an equal dispersion of ownership, stand-size class, and species. In each of the TRIs data were identified only for commercial forest land. These may therefore include some unavailable volumes.

The state forest on the western edge of the Fort Collins boundary is included in the boundary area. Information for the state forest is available in the Resource Management Plan for the Colorado State Forest and TRI No. 8 for Jackson County. The entire data for the forest were taken from the TRI. The information in this report reflected commercial forest land areas and volumes whereas the other source of data for these values was inadequate.

Part of the Fort Collins boundary includes Albany County, Wyoming. Estimates of state and private land for the county were taken from the Intermountain Station's 1970 data for the county. State and private data are also available from the State Forester in Wyoming. However, the Intermountain information was in a more readily available form. The Intermountain figures are for commercial forest land and no breakdown by standard or special components is available. Therefore, we assume species and ownerships are evenly distributed. A boundary adjustment factor was used to define the areas and volumes in the boundary. Only total areas and volumes for stand-size class were available for the county.

The TRIs and Intermountain county data were the best available sources from which state and private information could be obtained. Colorado has the highest quality state and private timber information of any state involved in this project.

Rough and rotten timber estimates were available in the preliminary TMPs for the Medicine Bow and Routt National Forests. The Roosevelt NF rough and rotten data were obtained from the timber management officer. Information for this category was not found for the Arapaho NF. The volumes of rough and rotten timber were prorated with boundary and availability factors when necessary. No rough and rotten data were found for state and private timbered areas.

Saratoga

Saratoga, Wyoming is located within the Medicine Bow NF. The Medicine Bow NF boundary constitutes the major part of Saragota's tributary area. The acreages and volumes of living material for this forest are shown in Table II-2. As stated

previously for the Fort Collins site only spruce-fir and lodgepole pine are considered commercial in the TMP for this forest. The acreages again reflect the currently available, or standard and special components, within the boundary. The volumes of total softwood are for the growing stock volumes prorated by the availability and boundary adjustment factors. Rough and rotten volumes are prorated from the TMP into the boundary using the availability and boundary adjustment factors for the forest.

Part of the Routt NF is also tributary to Saratoga. The land area of the Routt in the boundary was used to develop a boundary adjustment factor. With this factor the acreages and volumes in the boundary were determined from the TMP. As before, the growing-stock volume prorated into the boundary was adjusted by the availability factor to show standard and special volumes. However, acreages of species, by stand-size class, are given for the standard and special components on the national forest so only the boundary factor was used for adjustment of acreage. Still one must assume that standard and special components are evenly dispersed on commercial forest land. This is the best inventory information available for the Saratoga site. Rough and rotten data were also prorated from the TMP.

State and private information for Carbon County, Wyoming was taken from county data supplied by the Intermountain Station. The entire state and private information was used because the timber type map in the Forests of Wyoming (INT-2) illustrates that the timber in Carbon County is almost entirely within the boundary area. Only totals of areas and volumes by stand-size class could be procured from Intermountain Station data. No rough or rotten data were given. As with Albany County, state and private data were available at the State Forester's office but not used for reasons mentioned for Albany County.

A small portion of Routt County, Colorado is also tributary to Saratoga. However, a general ownership map published by the U.S. Geologic Survey depicts the area as being in the Routt NF. Therefore, no state and private estimates are necessary.

The area portion of Jackson County, Colorado that is in the boundary was used to develop a boundary adjustment factor. With this factor the commercial forest land areas and volumes in TRI No. 8 for state and private lands were prorated. Again, this assumes a uniform distribution of commercial forest land throughout the county. No rough and rotten information was found.

Dead Raw Material

Dead material (Tables II-3 and II-4) with its attendant sub-headings is detailed in the taxonomical scheme given in the introduction. Very little information is available for the general category of dead material.

There were two sources of data that list salvable dead volumes for the national forests. The Intermountain Station projected salvable dead volumes for each national forest's commercial forest land. Since no salvable dead data were available in the TMPs for the Roosevelt and Arapaho National Forests, the Intermountain data were used. However, even though the Intermountain information was more closely atuned to availability since it was for commercial forest land, it is felt that the TMPs yielded a better estimate of the salvable dead material because of more intense sampling on the forest. Therefore, because the TMPs for the Routt and Medicine Bow did list salvable dead for the entire NF (not just CFL), these figures were used. Boundary and availability adjustment factors were used to prorate the information into our boundary for the salvable dead category.

Salvable dead information for spruce-fir was obtained from a study (RM-125) that found 831 cubic feet/acre of standing and down dead spruce-fir material in Southern Colorado. This figure was applied to the acreages of spruce-fir sawtimber, poletimber, and seedlings and saplings given in the living material table. Therefore, the total salvable dead spruce-fir reflects the volume that is considered currently available. This figure was used when no other spruce-fir standing or down dead data were available. Standing dead volumes are available for each national forest in this report. However, because no standing or down dead volumes are listed for the counties, the figure above is used to find these values for each county. Salvable dead volumes of aspen were not recorded for the Medicine Bow NF because in the TMP aspen is unregulated, or not currently available.

Lodgepole pine down material was based solely on the INT-181 publication for down dead material. The down dead lodgepole pine volume in western Wyoming was 825 cu.ft./acre. This volume was projected into all lodgepole pine stands in Region 2. The acres of lodgepole pine sawtimber and poletimber in Tables II-1 and II-2 for each ownership were used to arrive at the down dead figure. Since the acreages in Tables II-1 and II-2 reflect our estimate of the land area that is currently available, then the down dead volume of lodgepole pine would also be available.

The logging residue figures were developed from the INT-135 publication. The intermountain Station estimates that in Colorado 10.43 percent of the cubic foot volume harvested annually will be left as residue in the woods. In Wyoming 7.68 percent of the harvest cubic foot volume is left as residue. An estimate of harvest volumes for 1975 is found in Tables II-6 and II-7 as annual programmed allowable cut. These projections of annual cut were used with the logging residue factor above to estimate the annual logging residue.

State and private annual harvest volumes were available for some of the counties in the Fort Collins area, thus a projection of the counties' logging residue was possible. For Saratoga, the harvest from state and private areas was determined in total but county data were not available. Therefore, the logging residue reported for Saratoga includes the state and private residue generated annually as well as that from the national forests.

Annual mortality figures were available for each national forest tributary to the two sites. Annual mortality on the Medicine Bow and Routt National Forests was a function of the growing stock volume. Boundary and availability adjustment factors were used to find the volumes of annual mortality considered currently available. This assumes an equal distribution of the growing stock from which annual mortality is generated.

Annual mortality figures for the Arapaho and Roosevelt were considered to be a function of commercial forest land. Therefore, our boundary and availability adjustment factors applied to these mortality volumes reflect material that is accessible by definition of commercial forest land. This implies that the volume of annual mortality is currently available. No annual mortality figures were discovered for state and private lands.

Potential Yield and Programmed Allowable Cut

The NF information in the TMPs lists potential yield and programmed allowable cuts for standard and special components. A boundary adjustment factor was used (when necessary) to prorate the future cut figures into the boundary area. These are shown in Tables II-5 and II-6. State and private future cuts are based on industry cuts over the last 10 years.

On the Routt, Roosevelt and Arapaho NFs our tabulated figures reflect the volumes of sawtimber and products that are scheduled for cutting. The Medicine Bow volume information also reflects sawtimber and products but the annual cut volume is for sawtimber only. With the better quality data on the Arapaho NF

we did not need to assume a uniform dispersion of the standard and special components to be cut as was done with the other national forests. The ranger district information, by components, allowed us to determine that no standard components were to be cut on the Clear Creek ranger district. Thus, only the special component data are presented.

Primary Wood Processors' Information

To gain a better overall view of the allocation of raw material at the two sites, representatives of the wood products industries were visited. Information regarding product and by-product volumes, costs, and values should aid in determining the economic availability of all raw materials at each site.

Conversations were held with producers of primary products at each of the two sites involved in this case study. This involved three producers in Fort Collins: Cook Lumber Co., Westridge Fence Co., and Crutchfield Lumber Co. In Saratoga the two producers were Hines Lumber Co. and Hammer Lumber and Timber Co. In order not to divulge any information based on the operation of an individual company, production, cost, and value data from the two sites have been aggregated in Table II-7. Costs and values from different sources have been averaged, and product and by-product volumes have been totaled.

Primary product and residue volumes, costs, and values were thus obtained for the November 1974 period. All information required was available for the Fort Collins site. Saratoga residue information, however, was available only for the volume of chips produced. The residues at that site were burned without any estimation of their volume, cost, or value. Chips at both sites were sold for pulping. In Fort Collins, the total residue volume was used for animal bedding. Table II-8 gives a summary of costs and values for the combined producers.

Forest Service costs and values of primary products, by-products and residues are presented as a Region 2 average in Table II-9. This information was taken from the Region 2 Title 2400 Timber Management supplement. Values of primary products are given in the November amendment to Title 2400 handbook for product values used in timber appraisals. Costs and values of chips are regional averages taken from the Title 2400 handbook. Stump to mill costs are also given in the Timber Management Title 2400 handbook for Region 2. The regional figures for fell and buck, skid, load, and overhead were taken from this Forest Service supplement. The Timber Management Offices on both the Roosevelt and Medicine Bow National Forests helped in developing short- and long-haul costs for the two sites. Stump

to mill costs vary with individual sales. The figures presented in Table II-9 should be considered as averages for the two sites.

References

1. Brown, Delmer. 1974. Private and State Timber Resources (vols.) Colorado State Forest Service, Colorado State University. Fort Collins, Colorado.

2. Brown, J. K. 1974. Reducing Fire Potential in Lodgepole Pine by Increasing Timber Utilization, INT-181. Intermountain Forest and Range Experiment Station, Ogden, Utah.

3. Choate, Grover A. 1963. The Forests of Wyoming, INT-2. Intermountain Forest and Range Experiment Station. Ogden, Utah.

4. Miller, R. L. and G. A. Choate. 1964. The Forest Resource of Colorado, INT-3. Intermountain Forest and Range Experiment Station. Ogden, Utah.

5. Sampson, G. R., H. E. Worth, and D. M. Donnelly. 1974. Demonstration Test of Inwoods Pulp Chip Production in the Four Corners Region, RM-125.

6. Setzer, T. S. 1973. Logging Residues on Harvesting Operations, Western South Dakota, Wyoming, Utah, and Colorado, (INT-135). Intermountain Forest and Range Experiment Station. Ogden, Utah.

7. USDA Forest Service. 1962. Timber Management Plan. Roosevelt National Forest. Fort Collins, Colorado.

8. USDA Forest Service. 1974. Working Papers of Timber Management Plan. Arapaho NF. Region 2 Office, Denver, Colorado.

9. USDA Forest Service. 1974. Extension of Timber Management Plan. Roosevelt NV. Region 2 Office, Denver, Colorado.

10. USDA Forest Service. 1974. Working Papers of Timber Management PLan. Medicine Bow NF. Region 2 Office, Denver, Colorado.

11. USDA Forest Service. 1974. Working Papers of Timber Management Plan. Routt NF. Region 2 Office. Denver, Colorado.

12. USDA Forest Service. Forest Survey Unit. Intermountain Forest and Range Experiment Station. Ogden, Utah.

13. USDA Forest Service. 1974. Title 2400 Timber Management: Region 2 Supplement No. 192. Region 2 Office. Denver, Colorado.

Agencies Consulted for Information

1. USDA Forest Service. Supervisor's Office, Arapaho - Roosevelt NF. Fort Collins, Colorado.

2. USDA Forest Service. Supervisor's Office, Medicine Bow NF. Laramie, Wyoming.

Individuals Contacted for Information

1. Mr. James Craine, Hines Lumber Co., Saratoga, Wyoming.
2. Mr. Jim Hammer, Hammer Lumber Co., Saratoga, Wyoming.
3. Mr. Frank Cook and Mr. Carl Spaulding, Cook Lumber Co., Fort Collins, Colorado.
4. Mr. Fay Crutchfield, Crutchfield Lumber Co., Fort Collins, Colorado.

Table II-1. Living Raw Material Tributary to Ft. Collins, Colorado.

Geographic Location / Information Source	Boulder Co. TRI Release No. 14		Gilpin Co. TRI Release No. 14		Clear Creek Co. TRI Release No. 14		Larimer Co. TRI Release No. 1	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber								
Spruce-fir type	5,700	18,285	2,100	7,850	5,400	14,412	N/A	N/A
Douglas-fir type	2,800	3,046	1,400	597	3,500	2,840	6,900	4,444
Lodgepole pine type	2,900	5,808	0	0	1,700	2,267	3,400	3,995
Ponderosa pine type	13,500	12,473	2,100	1,931	3,500	2,597	8,700	7,491
Aspen type	0	0	0	0	0	0	N/A	N/A
Total Sawtimber	24,900	39,612	5,600	10,378	14,100	22,116	19,000	15,930
Poletimber								
Spruce-fir type	1,000	2,465	2,800	4,608	4,400	8,208	N/A	N/A
Douglas-fir type	6,700	5,799	2,100	1,748	5,200	5,859	15,600	10,046
Lodgepole pine type	13,400	16,355	16,300	19,794	14,200	19,755	26,100	30,667
Ponderosa pine type	21,000	19,140	N/A	N/A	900	938	19,000	16,359
Aspen type	1,700	2,362	1,100	1,014	2,300	3,464	N/A	N/A
Total Poletimber	43,800	46,121	22,300	27,164	27,000	38,224	60,700	57,072
Seedling and Saplings								
Spruce-fir type	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Douglas-fir type	N/A	N/A	N/A	N/A	N/A	N/A	1,700	1,095
Lodgepole pine type	N/A	N/A	2,100	345	1,600	173	10,400	12,220
Ponderosa pine type	N/A	N/A	N/A	N/A	N/A	N/A	3,500	3,014
Aspen type	2,200	976	1,900	427	700	34	N/A	N/A
Total Seedling & Saplings	2,200	976	4,000	772	2,300	207	15,600	16,329
Rough								
Softwood								
Hardwood								
Total Rough	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Rotten								
Softwood								
Hardwood								
Total Rotten	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: "N/A" signifies that certain information was not available at the time of this study. In some cases, total information was available, but individual data were not.

TABLE II-1 (Continued)

Geographic Location / Information Source	Colo. State Forest TRI Release No. 8		Jefferson Co. TRI Release No. 15		Albany County, Wyo. INT- Forest Survey		Roosevelt Nat'l Forest 1972 Amend to TMP	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber								
Spruce-fir type	3,200	32,040	0	0	N/A	N/A	15,091	31,356
Douglas-fir type	0	0	4,050	3,586	N/A	N/A	1,744	1,044
Lodgepole pine type	3,200	15,834	0	0	N/A	N/A	21,474	22,896
Ponderosa pine type	0	0	10,920	10,230	N/A	N/A	10,397	2,592
Aspen type	0	0	0	0	N/A	N/A	0	0
Total Sawtimber	6,400	47,874	14,970	13,816	32,500	38,596	48,706	57,888
Poletimber								
Spruce-fir type	7,300	8,443	510	1,316	N/A	N/A	2,693	5,213
Douglas-fir type	0	0	8,610	8,886	N/A	N/A	35,586	2,960
Lodgepole pine type	26,700	60,824	5,580	6,660	N/A	N/A	52,122	42,998
Ponderosa pine type	0	0	5,820	6,002	N/A	N/A	14,206	4,330
Aspen type	7,500	17,173	255	472	N/A	N/A	2,096	501
Total Poletimber	41,500	86,440	20,775	23,336	16,000	24,931	106,703	56,002
Seedling and Saplings								
Spruce-fir type			N/A	N/A	N/A	N/A	22	
Douglas-fir type			N/A	N/A	N/A	N/A	11	
Lodgepole pine type			1,530	140	N/A	N/A	2,193	
Ponderosa pine type			N/A	N/A	N/A	N/A	22	
Aspen type			255	58	N/A	N/A	428	
Total Seedling & Saplings	N/A	N/A	1,785	198	2,500	N/A	2,676	N/A
Rough								
Softwood								2,267
Hardwood								39
Total Rough	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,306
Rotten								
Softwood								8,618
Hardwood								586
Total Rotten	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9,204

Fort Collins

TABLE II-1 (Continued)

Geographic Location / Information Source	Arapaho NF (Clear Creek RD) 1974 TM Plan		Medicine Bow NF 1973 TM Plan		Routt NF 1973 TM Plan		Total of Table II-1 Living Matl.	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber								
Spruce-fir type	6,240	30,420	17,174		5,462	10,510		
Douglas-fir type	N/A	N/A	0		258	222		
Lodgepole pine type	2,368	8,738	22,657		3,684	7,620		
Ponderosa pine type	N/A	N/A	0		0	0		
Aspen type	N/A	N/A	0	N/A	2,465	2,682		
Total Sawtimber	8,608	39,158	39,831	43,610	11,869	21,034	226,484	350,012
Poletimber								
Spruce-fir type	1,236	2,125	3,017		1,185	1,424		
Douglas-fir type	N/A	N/A	0		0	0		
Lodgepole pine type	2,751	5,552	8,898		1,502	2,670		
Ponderosa pine type	N/A	N/A	0		0	0		
Aspen type	N/A	N/A	0	N/A	2,326	2,346		
Total Poletimber	3,987	7,677	11,915	10,550	5,013	6,440	359,693	383,957
Seedlings and Saplings								
Spruce-fir type	1,118		4,068		2,639	610		
Douglas-fir type	N/A		0		0	0		
Lodgepole pine type	2,489		2,202		405	198		
Ponderosa pine type	N/A		0		0	0		
Aspen	N/A		0	N/A	1,404	326		
Total Seedlings & Saplings	3,607	N/A	6,270	2,550	4,448	1,134	45,386	22,116
Rough								
Softwood				1,600		410		
Hardwood				0		162		
Total Rough	N/A	N/A	N/A	1,600	N/A	572	N/A	4,478
Rotten								
Softwood				900		436		
Hardwood				0		636		
Total Rotten	N/A	N/A	N/A	900	N/A	1,072	N/A	11,176

TABLE II-2. Living Raw Material Tributary to Saratoga, Wyoming

Geographic Location / Information Source	Medicine Bow Nat'l Forest Med. Bow NF TM Plan		Routt Nat'l Forest Routt NF TM Plan		Carbon County INT-Ogden		Jackson County TRI#8 CSFS		Total of Table II-2 Living Mt	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber:										
Spruce-fir type	52,533	N/A	10,925	21,020	N/A	N/A	0	0		
Douglas-fir type	0	0	516	444	N/A	N/A	0	0		
Lodgepole pine type	69,304	N/A	7,369	15,240	N/A	N/A	240	869		
Ponderosa pine type	0	0	0	0	N/A	N/A	0	0		
Hardwoods	0	0	4,930	5,364	N/A	N/A	80	84		
Total Sawtimber	121,837	148,274	23,740	42,068	37,000	80,114	320	953	182,897	271,409
Poletimber:										
Spruce-fir type	9,229	N/A	2,371	2,848	N/A	N/A	320	1,408		
Douglas-fir type	0	0	0	0	N/A	N/A	0	0		
Lodgepole pine type	27,217	N/A	3,004	5,340	N/A	N/A	1,344	3,034		
Ponderosa pine type	0	0	0	0	N/A	N/A	0	0		
Hardwoods	0	0	4,652	4,692	N/A	N/A	1,696	3,720		
Total Poletimber	36,446	35,870	10,027	12,880	24,000	26,820	3,360	8,162	73,833	83,732
Seedlings & Saplings										
Spruce-fir type	12,444	N/A	5,278	1,220	N/A					
Douglas-fir type	0	0	0	0	N/A					
Lodgepole pine type	6,735	N/A	810	396	N/A					
Ponderosa pine type	0	0	0	0	N/A					
Hardwoods	0	0	2,808	652	N/A					
Total Seedlings & Saplings	19,179	8,670	8,896	2,268	3,000	N/A	N/A	N/A	31,075	10,938
Rough										
Softwood		5,440 1/		820						
Hardwood		0		324						
Total Rough	N/A	5,440	N/A	1,144	N/A	N/A	N/A	N/A	N/A	6,584
Rotten										
Softwood		3,060		872						
Hardwood		0		1,272						
Total Rotten	N/A	3,060	N/A	2,144	N/A	N/A	N/A	N/A	N/A	5,204

NOTE: "N/A" signifies that certain information was not available at the time of this study. In some cases total information was available, but individual data were not.

1/ Rough and rotten on Bow are in sawtimber size only -- 9"+ dbh to 4" top dib.

TABLE II-3. Dead Raw Material Tributary to Ft. Collins, Colorado

Geographic Location	Boulder County	Gilpin County	Clear Creek County	Larimer County	Jefferson County	State Forest	Roosevelt NF	Arapaho NF	Routt NF	Medicine Bow NF
	MCF	MCF	MCF	MCF	MCF	MCF	MCF	MCF	MCF	MCF
Salvable Dead										
Standing										
Spruce-fir type	5,567[1]	4,071	8,142		423	8,724			1,230	4,550
Douglas-fir type										
Lodgepole pine type										
Ponderosa pine type										
Aspen type									26	0
Total	5,567	4,071	8,142	N/A	423	8,724	4,842	4,260	1,256	4,550
Down										
Spruce-fir type										
Douglas-fir type										
Lodgepole pine type	13,448	13,448	13,118	24,338	4,604	24,668	60,717	4,223	4,278	13,786
Ponderosa pine type										
Aspen type										
Total	13,448	13,448	13,118	24,338	4,604	24,668	60,717	4,223	4,278	13,786
Logging Residue										
Spruce-fir type										
Douglas-fir type										
Lodgepole pine type										
Ponderosa pine type										
Aspen										
Total Logging Residue/yr.	1	0	0	916	0	0	239	9	41	112
Annual Mortality										
Spruce-fir type								192	114	150
Douglas-fir type										
Lodgepole pine type								116	32	175
Ponderosa pine fir										
Aspen									46	
Total Annual Mortality	N/A	N/A	N/A	N/A	N/A	N/A	8,421	308	192	325

Spruce-fir standing dead from 831 cft/acre for standing and down dead (RM-125)

NOTE: "N/A" signifies that certain information was not available at the time of this study. In some cases total information was available, but individual data were not.

TABLE II-4. Dead Raw Material Tributary to Saratoga, Wyoming.

Geographic Location Source	Med.Bow TMP	Routt TMP	Carbon County	Jackson County,CO
	MCF	MCF	MCF	MCF
Salvable Dead				
Standing Mtl.				266[4]
Spruce-fir	15,470[1]	2,460		
Douglas-fir				
Lodgepole				
Ponderosa				
Aspen	0	52		
Total Standing	15,470	2,512	N/A	266
Down Mtl.				
Spruce-fir				
Douglas-fir				
Lodgepole	79,630	8,558		1,307
Ponderosa				
Aspen				
Total	79,630	8,558	N/A	1,307
Logging Residue/yr				
Spruce-fir				
Douglas-fir				
Lodgepole				
Ponderosa				
Aspen				
Total Logging Res/yr	253	71	N/A	38[3]
Annual Mortality				
Spruce-fir	510	228[2]		
Douglas-fir				
Lodgepole	595	64		
Ponderosa				
Aspen		92		
Total Annual Mort.	1,105	384	N/A	N/A

1 For sawtimber only, ie., 9" dbh and greater to 4" top dib

2 Includes spruce-fir and Douglas-fir

3 Reflects 38MCF S & P residue for Carbon and Jackson Counties

4 SF standing dead for both standing dead and down dead from RM-125 @831.0 cuft/acre

NOTE: "N/A" signifies that certain information was not available at the time of this study.

TABLE II-5. Potential Yield and Programmed Allowable Cut for Saratoga, Wyoming

Geographic Location	Medicine Bow		Routt		State & Private	
	Acres	MCF	Acres	MCF	Acres	MCF
Potential Yield (10 year)						
Standard	34,424	41,527	7,749	11,702		
Special	1,560	1,030	151	135		
Total	35,984	42,557	7,900	11,837	N/A	N/A
Annual Programmed Allowable Cut						
Standard	2,392	2,850	893	883		
Special	520	442	46	35		
Total	2,912	3,292	939	918	N/A	500

NOTE: "N/A' signifies that certain information was not available at the time of this study. In some cases total information was available, but individual data were not.

TABLE II-6. Potential Yield and Programmed Allowable Cut for Ft. Collins.

Geographic Location	Roosevelt[1]		Routt		Arapaho		Medicine Bow		State & Private	
	Acres	MCF	Acres	sawtimber MCF	Acres	MCF	Acres	sawtimber MCF	Acres	MCF
Potential Yield (10 years)										
Standard	4,090	9,046	3,340	5,447	0	0	11,254	13,576		
Special	577	1,248	65	62	3,654	4,482[2]	510	337		
Total	4,667	10,294	3,405	5,509	3,654	4,482	11,764	13,913	N/A	N/A
Annual Programmed Allowable Cut										
Standard	3,097	2,292	385	411	0	0	782	932		
Special	N/A	N/A	20	16	198	90	170	144		
Total	3,097	2,292	405	427	198	90	952	1,076	N/A	915.5[3]

1/ Roosevelt TM plan effective 1975-77 only

2/ For sawtimber vols. only

3/ Includes Larimer and Boulder Counties only

NOTE: "N/A" signifies that certain information was not available at the time of this study. In some cases total information was available, but individual data were not.

TABLE II-7. Combined Production Data for Saratoga, Wyoming and Ft. Collins, Colorado as of November 1974

Total Annual Primary Product Volume	
Lumber	33.75 MMBF
Posts and Poles 1/	2984 cords SWE*
Average Value of Product FOB mill	
Lumber	$115/MBF
Posts and poles (treated)	175.94/cord
Average Milling Costs	
Lumber	$45/MBF
Posts and poles (treated)	126.67/cord
Average Raw Material Costs to Mill	
Lumber	$75/MBF
Posts and poles	8.21/cord
Total Volume Mfg. Residue	
Chips	27,301 units/yr.
Bark, shavings, etc	23,750 units/yr. plus undetermined vol. slabs & edgings
Use of residue	Chips used for pulp. Ft. Collins by-products for animal bedding Saratoga residues burned
Average Cost of Residues	
Chips	$5.00/unit
By-products	N/A
Average Value of Residues	
Chips	$9.00/unit
By-products	$7.00/unit 2/
Combined Species Utilized	LP, SF, DF, PP

*Solid wood equivalent

1/ Posts & poles based on average product - 6.5' post 4" diameter

2/ Compared with coal -- an unregulated energy source as to price -- on the basis of equivalent thermal content and with coal valued at $0.69/MM Btu, hogged residue fuel would be valued at $9.42/unit.

TABLE II-8. Average Product Costs and Values for Ft. Collins, Colorado and Saratoga, Wyoming

	Lumber	Posts and Poles
Value FOB Mill	$115/MBF	$176/cord
Milling Cost	(45/MBF)	(127/cord)
Raw Material Cost	(75/MBF)	(8/cord)

TABLE II-9. U.S. Forest Service Estimates for Production Information for the Central Rockies Portion of Region 2

Primary Product Value for Lumber		$100.26/MBF -LP 132.13/MBF - DF 125.65/MBF - SF 182.39/MBF - PP	
Milling Costs (Lumber)		$64.04/MBF	
Raw Mtl. Costs to the Mill		Ft. Collins	Saratoga
	Fell & Buck	$11.97	10.88
	Skid	17.81	16.19
	Load	5.96	5.42
	Overhead	7.47	7.47
		43.21	39.96
	Long 1-way trip	26.80(132 miles)	18.56(49 miles)
	Short 1-way trip	14.09 (68 miles)	9.50 (25 miles)
Costs associated with Residues	Chips	$3.20/unit	
	By-products	0.19/unit	
Value of Residues	Chips	$3.74/unit	
	By-products	0.34/unit	

CASE STUDY III: PAGOSA SPRINGS AND MONTROSE, COLORADO

Summary

The Montrose site has 1,411,900 MCF of living raw material in the boundary. Within the Pagosa Springs boundary 193,150 MCF of living raw material were found to be currently available. The best and most reliable data sources for the sites of Montrose and Pagosa Springs were the Federal and State Forest Services. These two sources had the most recent surveys of growing stock areas and volumes. The Bureau of Indian Affairs (BIA) was the only reliable source of information on the Southern Ute Reservation.

Several other repositories of information were examined for possible data. None of the raw data exactly fit our boundary areas. In order to extract area and volume estimates, planimetered acreages within our boundary were used as percentages of the entire data source, thus providing a basis for prorating resources to our tributary area. Of course, this process reduces the reliability of the estimates.

Because high-quality descriptions of state and private land are available through Colorado's State Forest Service, the Montrose state and private estimates were not based strictly on the percent of land within the boundary. Instead ownership and timber type maps in the TRIs were used to more clearly enumerate areas and volumes of state and private timber for the counties tributary to Montrose. By using this method we were able to acquire information without having to make the assumption of homogeneity of ownership and timber distribution as had to be done on federal lands.

Total standing dead material for the Montrose boundary was 68,670 MCF and 5,930 MCF for Pagosa Springs. The national forest estimates were prorated from the TMPs. This, of course, tends to lessen the credibility of the figures. However, state and private estimates projected from the RM-125 publication are even less reliable. The state and private figures for spruce-fir standing dead represent both standing and down dead material.

The Montrose site had 55,120 MCF of down dead material while none could be projected for Pagosa Springs. The down dead material is developed from an INT-181 study that was conducted in Wyoming. Thus the figures presented in Table III-3 may be questioned as to their reliability. No lodgepole pine acreages were given for Pagosa Springs -- thus no down dead projections were possible.

Logging residues of 462 MCF were determined for the Montrose site and 185 MCF for Pagosa Springs. If the projected annual cuts for 1975 and subsequent years in Tables III-5 and 6 are met, and the logging residues generated confirm those given in INT-135, then the tabulated residue data will be reliable.

Total annual mortality figures were found for the national forests but not for state and private land. These figures were 2,577 MCF for Montrose and 495 MCF for Pagosa Springs. Each national forest estimates its annual mortality. From this information standard and special component volumes were prorated into both of the tributary area boundaries. Prorating, of course, tends to reduce reliability.

For Montrose and Pagosa Springs combined the total input volume into the mills was 62 MMBF for lumber and 2.5 MMBF for house logs and siding. The managers and/or owners of the wood-using industries at each site supplied this information.

They also estimated that 13,800 units/year of chips were generated along with 48,000 units/year of bark, sawdust, shavings, etc. Not all the managers were able to determine manufacturing residue volumes.

Average production costs and values were also obtained from the managers. Production costs included material costs to the mill and manufacturing costs. These averaged $98.75/MBF for lumber with only milling costs of $27.50/MBF available for house logs and siding. The average product value for lumber was $116/MBF for the two sites. The average house log and siding value was $200/MBF.

At the time of this writing none of the TMPs were in the final stage. Therefore, the programmed allowable cut figures as well as the potential yields may yet be readjusted by the Forest Service. The areas and volumes on federal lands, except Bureau of Indian Affairs land, reflect that portion that is currently available. The Ute Reservation and state and private lands had no future cut estimates. Operators' averages of past cuts on these areas were used to estimate future cut.

The Forest Service's cost and value information was gathered to complete the availability picture. These figures were checked with the areas' primary wood products operators. Lumber, house logs, siding, and fireplace logs made from residue were the principal products. Chips were shipped to a pulp mill, and by-products became fireplace logs or were disposed of by burning.

Introduction

Pagosa Springs and Montrose both lie in the southwestern quarter of Colorado. Montrose is in Montrose County and is surrounded by the Grand Mesa-Uncompahgre and Gunnison National Forests. This town has two large sawmills, a large resaw plant, and an operation making fireplace logs from local mill residues. The major highways running through the town are U.S. 50 and 550. There is also rail service via the Denver and Rio Grande Western.

Pagosa Springs lies in the rugged San Juan Mountains. The San Juan National Forest is immediately adjacent to the city while to the south is the Ute Indian Reservation. There is one major sawmill in the town, and two producers of house logs and other small wood products. Two major highways, U.S. 84 and 160, provide the town's access to the outside world.

The commercial timber species in this area include Engelmann spruce and subalpine fir in the spruce-fir type. Other commercial species are Douglas-fir, white fir, ponderosa pine, and aspen.

The sites of Pagosa Springs and Montrose were combined in this analysis because of their proximity to one another. However, data on areas and volumes of raw material are presented for the individual sites. Costs, values, and production data are combined so that information on no single individual firm may be identified.

The boundaries for each site were drawn to represent the area that has raw material considered to be tributary to Pagosa Springs or Montrose. These tributary areas are shown in Figures III-1 and III-2, for Montrose and Pagosa Springs, respectively. For Montrose, the boundaries were established with the aid of the Timber Management officers on the Gunnison National Forest. Timber management personnel of the San Juan National Forest were queried to determine the Pagosa Springs boundary. Originally, the Pagosa Springs boundary included a portion of New Mexico in Region 3. Further investigation revealed that no timber had moved to Pagosa Springs from New Mexico since around 1945. This information was given to us by the Deputy Resource Director on the Carson National Forest and by the forestry group on the Southern Ute Reservation. The possibility for future movement of New Mexico's timber into Pagosa Springs was dubious, therefore the boundary was adjusted to the Colorado-New Mexico border.

Occasionally, the boundaries for each site did not conform to established land boundaries such as counties and National Forests. The procedure in these cases was

Figure III-1. Area tributary to Pagosa Springs, CO.

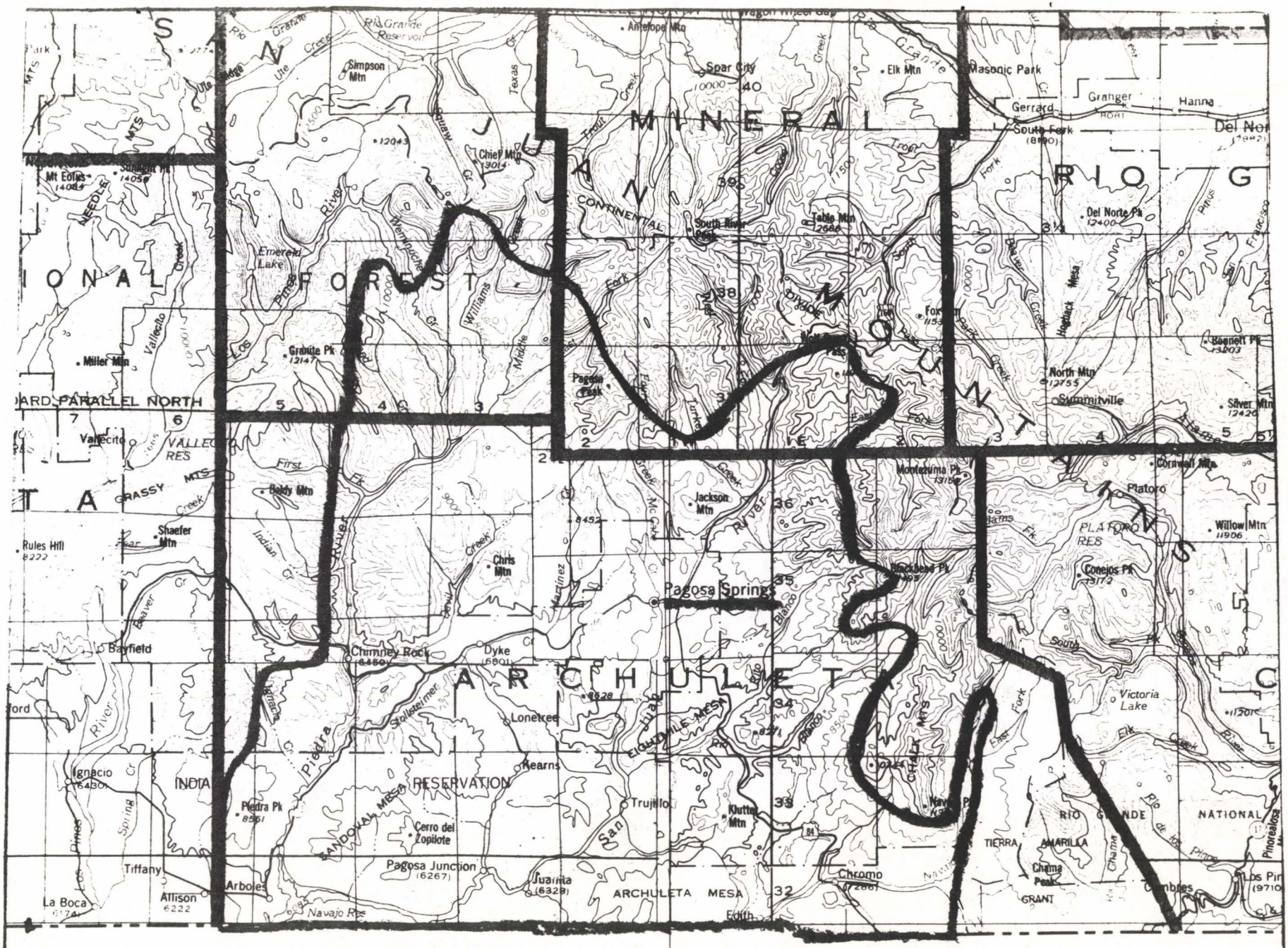
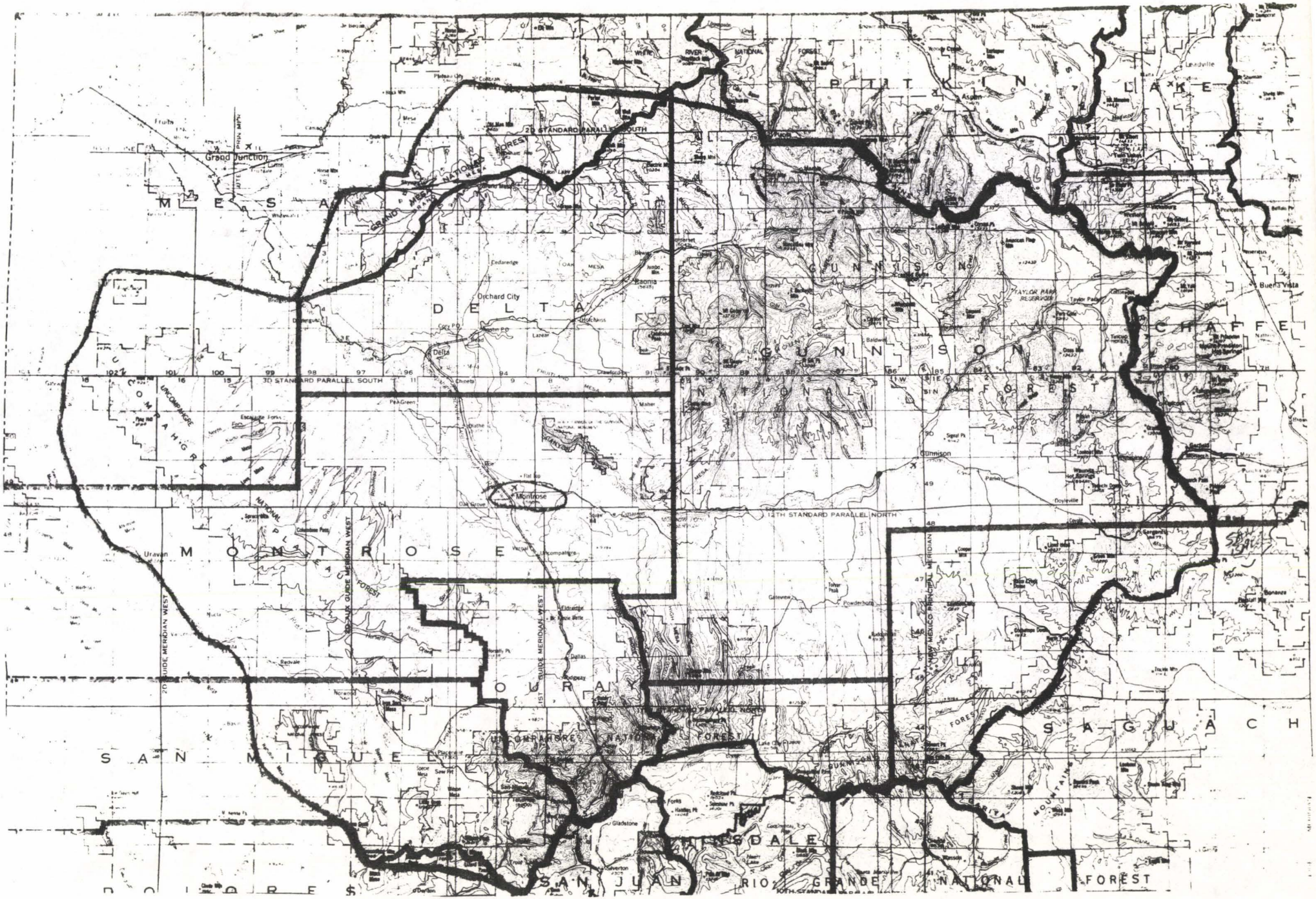

MINERAL
RIO GRANDE
NATIONAL FOREST
ARCHULETA
Pagosa Springs
Pagosa Junction
Chromo
Arboles
Bayfield
Ignacio
Tiffany
Allison
La Boca
Vallecito
Platoro
Summitville
Del Norte Pk
Spar City
Masonic Park
Gerrard
Granger
Hanna
South Fork
Elk Mtn
Antelope Mtn
Simpson Mtn
Chief Mtn
Granite Pk
Miller Mtn
Mt Eolus
Needle Mts
Rules Hill
Shaefer Mtn
Baldy Mtn
Chris Mtn
Jackson Mtn
Chimney Rock
Dyke
Lonetree
Kearns
Trujillo
Cerro del Zopilote
Piedra Pk
Juanita
Navajo Res
Sandoval Mesa
Archuleta Mesa
Table Mtn
South River Peak
Pagosa Peak
North Mtn
Silver Mtn
Bonniett Pk
Montezuma Pk
Cornwall Mtn
Willow Mtn
Conejos Pk
Blackhead Pk
Victoria Lake
Chama Peak
Tierra Amarilla
Grant
Edith
Los Pinos
Navajo River
Piedra River
San Juan River
Rio Grande
Continental Divide
Wagon Wheel Gap
Rio Grande Reservoir
Emerald Lake
Vallecito Res
Platoro Res
Grassy Mts
Los Pinos Indian Reservation
Ute Mtn Ute Indian Reservation
Ute Creek
Texas Creek
Trout Creek
Goose Creek
Weminuche Creek
Williams Creek
Middle Creek
Turkey Creek
Beaver Creek
Hogback Mesa
Navajo River
Los Pinos River
Indian Creek
Beaver Creek
Stollsteimer Creek
Martinez Creek
Jarosa Creek
Blanco River
Hams Fk
Elk Creek
Chama River
Rio de los Pinos
Pinos
Francisco
Navajo Res
Edith
Archuleta Mesa
Los Pinos
Chromo
Tierra Amarilla
Chama Peak
Grant
Combbes
Los Pin
Rio Grande National
Pinorealos
Del Nor
Fork
Creek
River
Mts
Park
Ridge
Basin
Gulch
Canyon
Mesa
Reservoir
Res
Pk
Mtn
Mtns
Junction
Springs
Lake
Meadows
Valley
Hill
Hills
Cr
Fk
Ave
Rd
Dr
Ln
St
Blvd
Pl
Ct
Trail
Path
Way
Circle
Terrace
Heights
Estates
Village
Center
Plaza
Square
Park
Field
Fields
Grove
Groves
Orchard
Orchards
Garden
Gardens
Farm
Farms
Ranch
Ranches
Stable
Stables
Barn
Barns
Shed
Sheds
Garage
Garages
Driveway
Parking
Lot
Lots
Space
Spaces
Entrance
Exit
Gate
Gates
Fence
Fences
Wall
Walls
Sign
Signs
Light
Lights
Pole
Poles
Wire
Wires
Cable
Cables
Pipe
Pipes
Tank
Tanks
Tower
Towers
Antenna
Antennas
Dish
Dishes
Satellite
Satellites
Receiver
Receivers
Transmitter
Transmitters
Transceiver
Transceivers
Modem
Modems
Router
Routers
Switch
Switches
Hub
Hubs
Server
Servers
Computer
Computers
Laptop
Laptops
Desktop
Desktops
Tablet
Tablets
Phone
Phones
Smartphone
Smartphones
Camera
Cameras
Video
Videos
Audio
Audios
Speaker
Speakers
Microphone
Microphones
Headphone
Headphones
Earphone
Earphones
Headset
Headsets
Keyboard
Keyboards
Mouse
Mice
Trackpad
Trackpads
Touchscreen
Touchscreens
Display
Displays
Monitor
Monitors
Projector
Projectors
Screen
Screens
Printer
Printers
Scanner
Scanners
Copier
Copiers
Fax
Faxes
Machine
Machines
Device
Devices
Gadget
Gadgets
Tool
Tools
Equipment
Equipments
Material
Materials
Supply
Supplies
Product
Products
Service
Services
Company
Companies
Business
Businesses
Industry
Industries
Market
Markets
Economy
Economies
Finance
Finances
Money
Moneys
Bank
Banks
Account
Accounts
Credit
Credits
Debit
Debits
Loan
Loans
Mortgage
Mortgages
Insurance
Insurances
Investment
Investments
Stock
Stocks
Bond
Bonds
Fund
Funds
Trust
Trusts
Asset
Assets
Liability
Liabilities
Equity
Equities
Capital
Capitals
Profit
Profits
Loss
Losses
Revenue
Revenues
Expense
Expenses
Budget
Budgets
Tax
Taxes
Income
Incomes
Salary
Salaries
Wage
Wages
Job
Jobs
Career
Careers
Profession
Professions
Occupation
Occupations
Employment
Employments
Unemployment
Unemployments
Retirement
Retirements
Pension
Pensions
Benefit
Benefits
Insurance
Insurances
Health
Healths
Medical
Medicals
Doctor
Doctors
Nurse
Nurses
Hospital
Hospitals
Clinic
Clinics
Pharmacy
Pharmacies
Medicine
Medicines
Drug
Drugs
Vaccine
Vaccines
Virus
Viruses
Disease
Diseases
Illness
Illnesses
Sickness
Sicknesses
Death
Deaths
Birth
Births
Life
Lives
Time
Times
Year
Years
Month
Months
Week
Weeks
Day
Days
Hour
Hours
Minute
Minutes
Second
Seconds
Clock
Clocks
Watch
Watches
Calendar
Calendars
Date
Dates
Schedule
Schedules
Plan
Plans
Goal
Goals
Objective
Objectives
Strategy
Strategies
Tactic
Tactics
Method
Methods
Process
Processes
Procedure
Procedures
Technique
Techniques
Skill
Skills
Knowledge
Knowledges
Information
Informations
Data
Datas
Fact
Facts
Figure
Figures
Number
Numbers
Statistic
Statistics
Graph
Graphs
Chart
Charts
Table
Tables
Diagram
Diagrams
Map
Maps
Atlas
Atlases
Globe
Globes
Compass
Compasses
GPS
GPSes
Navigation
Navigations
Direction
Directions
Route
Routes
Road
Roads
Highway
Highways
Street
Streets
Avenue
Avenues
Boulevard
Boulevards
Drive
Drives
Lane
Lanes
Court
Courts
Place
Places
Square
Squares
Circle
Circles
Terrace
Terraces
Heights
Estates
Village
Villages
Center
Centers
Plaza
Plazas
Square
Squares
Park
Parks
Field
Fields
Grove
Groves
Orchard
Orchards
Garden
Gardens
Farm
Farms
Ranch
Ranches
Stable
Stables
Barn
Barns
Shed
Sheds
Garage
Garages
Driveway
Driveways
Parking
Parkings
Lot
Lots
Space
Spaces
Entrance
Entrances
Exit
Exits

Figure III-2. Area tributary to Montrose, CO.


Grand Junction
Fruita
Palisade
Clifton
Orchard City
Delta
Hotchkiss
Paonia
Somerset
Redvale
Uravan
Naturita
Nucla
Norwood
Placerville
Telluride
Ophir
Gateway
Dolores
Rico
Dunton
Egnar
Lizard Head Pass
Ophir Pass
Dallas Divide
Cimarron
Montrose
Olathe
Peak Green
Escalante Forks
Chipeta
Maher
Cedaredge
Powderhorn
Gunnison
Crested Butte
Marble
Redstone
Carbondale
Glenwood Springs
Aspen
Leadville
Buena Vista
Salida
Gladstone
Forks
Lake City
Creede
Del Norte
Monte Vista
Alamosa
Saguache
Baldwin
Doyleville
Parlin
Sapinero
Cebolla
Taylor Park Reservoir
Tincup
Pitkin
Lake
Gunnison
Chaffee
Saguache
Mesa
Delta
Montrose
San Miguel
Ouray
Hinsdale
Rio Grande
Dolores
San Juan
Uncompahgre National Forest
Gunnison National Forest
Grand Mesa National Forest
Rio Grande National Forest
San Juan National Forest
Uncompahgre Plateau
Uncompahgre
Grand Mesa
Taylor Park Reservoir
Sawatch Mountains
Sangre de Cristo Mountains
3D STANDARD PARALLEL SOUTH
2D STANDARD PARALLEL SOUTH
12TH STANDARD PARALLEL NORTH
6TH PRINCIPAL MERIDIAN
NEW MEXICO PRINCIPAL MERIDIAN
1ST UTE MERIDIAN WEST
2D UTE MERIDIAN WEST
3D UTE MERIDIAN WEST

to use that portion of the boundary that was within an established land unit as a percent of the total land unit. This percent was obtained by planimetering the land area that was within the boundary to determine the total number of acres. This acreage figure was then divided by the total acreage of the land unit to give a boundary adjustment factor.

Living Raw Material

Montrose

The Montrose boundary includes three national forests and several Colorado counties. Some of these ownerships were entirely in the boundary and others only partially so.

For the Montrose tributary area:

A. Total acreage and volume figures used in their entirety:
   1. Gunnison and Uncompahgre National Forests
   2. Ouray County
   3. Gunnison County
   4. Delta County

B. Land ownerships where portions of acreages and volumes were used:
   1. Mesa County
   2. Montrose County
   3. San Miguel County
   4. Hinsdale County
   5. Saquache County
   6. Grand Mesa National Forest

Working papers for the timber management plans were available at the Region 2 office in Denver and were used as the source of national forest information for the three forests. County information was obtained from the Timber Resource Inventory (TRI) publications. The TRIs are published by the Colorado State Forest Service.

The standard and special components of the commercial forest land (CFL) represent the areas that are considered available for the next 10 years. These two components were 28 percent of the CFL on the Gunnison NF. This percentage was used to determine all volume and area figures so that currently available resources would be represented. The acreages and volumes of live timber on the Gunnison NF in Table III-1 represent the information available in the TMP only.

The Grand Mesa - Uncompahgre (GM-Unc) National Forests are combined by the Forest Service for management purposes. Therefore, the TMPs were combined. The entire Uncompahgre is within the Montrose boundary, However, only 78 percent of the Grand Mesa lies within Montrose's tributary area. For the combined GM-Unc, 1213 M acres of the total 1299 M acres (or 94 percent) are available to Montrose.

The 94 percent factor was used to adjust all areas and volumes of live material. Also, the currently available areas (standard and special components) were 22 percent of the CFL. Therefore, GM-Unc data were multiplied by 94 percent to determine the area within the boundary, then multiplied by 22 percent to get the resources considered currently available.

In the GM-Unc, rough and rotten values were given in the Timber Management Plan (TMP) whereas these figures were not available for the Gunnison NF. The volumes were subject to the adjustment factors mentioned above.

An alternative source for area and volume information was made available by the Intermountain Station of the U.S. Forest Service in Ogden, Utah. Another possible source of information was the Forest Resource of Colorado, INT-3, 1964. Both of these sources of information were based on much earlier surveys than the TMPs and did not give much insight into currently available timber.

State and private data detailed in the county's TRIs were in readily available form and were used in whole when the county was within our boundary. When the boundary included only part of a county adjustments were made in the areas and volumes. The state and private information , for the Montrose area only, was not generated by using percentage adjustment factors along. Because of the detail of the TRIs it was possible to determine ownership and species occurrence patterns within the counties. Thus, instead of assuming these two parameters to be evenly dispersed throughout a county we were able to determine relative proportions of ownership and species occurrence within our boundary for each county. This procedure has obvious advantages in accuracy. As previously stated, some county information was used in its entirety if the county was within the Montrose boundary. In Montrose County, TRI No. 11, we determined from the forest type map that only the pinon-juniper type was outside our boundary. Therefore total volumes and areas for the commercial species on state and private land were used for the county.

This same procedure was also used for San Miguel County where again the pinon-juniper was outside our boundary. Only 10 percent of the aspen type was outside

the boundary, therefore the aspen figures were reduced by 10 percent. All other areas and volumes of species were used in total.

For Hinsdale County the state and private land was planimetered in our boundary area. For planimetering we used the ownership map in the Colorado State Forest Service TRI No. 18. We found that 23,040 acres of state and private land were within our boundary. The TRI noted that the total state and private land is 30,997 acres with 6,700 acres of that being CFL. With this information we developed a proportion to find the tributary acreage of CFL on state and private land in Hinsdale County; e.g., 4,980 acres, or 0.7432 of the county's commercial forest land. The 0.7432 factor was used to adjust land and volume figures for Hinsdale County.

By inspection of the forest type mat in TRI No. 13 for Saguache County we assumed that one-half of the forest type was within our boundary. Therefore 50 percent of the land and volume figures for Saguache County were tabulated for the boundary area. This, of course, assumes a uniform dispersion of state and private lands in the county. No estimation of live rough and rotten timber was obtained for state and private land, the reason being that these volumes were not recorded in the TRI reports.

The TRIs were the only source of state and private information used in this area. No other published sources of data were discovered. None of the TRIs estimate the amount of land or volume that will be cut from commercial forest land. Therefore these figures do not reflect currently available data as do the standard and special components on the national forests.

Pagosa Springs

The boundary around Pagosa Springs encompassed only one national forest -- the San Juan. The planimetered area within the boundary was 0.182 of the total gross national forest area. The standard and special components were 0.221 of the total CFL. Therefore, the areas and volumes of the San Juan National Forest's CFL were multiplied by these two figures to obtain the currently available area and volumes within the boundary. This again assumes a homogeneous distribution of species and stand-size class throughout the national forest.

The information on the San Juan NF was taken from the working papers of the TMP in the Region 2 office. Alternate sources of data were those previously mentioned for the Montrose site.

State and private measurements were again made from the TRIs. Only portions of Hinsdale, Archuleta, and Mineral Counties were used. A boundary adjustment factor was developed for each county. In this case, the adjustment factor was used to prorate the county data for our area. Uniform dispersion of species and stand-size class was assumed.

No values for seedlings and saplings, and rough and rotten were listed in the TRIs. No other sources for this information on state and private land were discovered. Acreage and volume data for the living material tributary to Pagosa Springs are found in Table III-2.

Portions of the Southern Ute Indian Reservation were in the Pagosa Springs boundary. The reservation is in both Archuleta and LaPlata Counties in Colorado but, as Figure III-2 shows, only the Archuleta County portion of the reservation is in the boundary of the Pagosa Springs site. The only source for information on the reservation was the Forestry Department of the Bureau of Indian Affairs in Ignacio, Colorado. From data gathered through this department it was learned that 30,178 acres of the total 125,525 acres of reservation land in Archuleta County, or 24 percent, were commercial forest land. From the TRI publications for Archuleta and LaPlata Counties it was found that the acreage of the total reservation is 318,890 acres. Our area of 125,525 acres is 0.40 of this total. Therefore, acreages of sawtimber species, supplied by the BIA, were multiplied by 0.40 to find the area of reservation land in Archuleta County. This value multiplied by 0.24, then, yields the number of acres commercially available in the boundary for the reservation.

Currently, the Forestry Department on the reservation is completing their inventory. Due to this and the alleged inadequacy of earlier data only acreage values for sawtimber species were available for our use. These acreage values were multiplied by the above adjustment factors to get the sawtimber acreage by species.

TRI No. 9 for Archuleta County gives average volume/acre figures for each species of sawtimber on CFL. These volume/acre figures were multiplied by the number of sawtimber acres to get the volume by species on the Ute Reservation. There were no inventoried volumes of spruce-fir. It should be noted that the sawtimber designation on the reservation is based on a minimum 12 inches DBH, thus differing from other ownerships. The portion of Archuleta County that is not reservation land; i.e., state and private, is presented in Table III-1.

Dead Raw Material

Volumes of dead material according to the classification scheme was difficult to determine. Dead material volumes on the Gunnison and GM-Unc National Forests were provided by the timber management group on the Gunnison National Forest. The Gunnison and Unchmpahgre NF data were taken from the Stage I inventory. The Grand Mesa data came from the inventory for the Timber Resource Review 1970. These data are presented in Table III-3. All of the dead material figures for Pagosa Springs represent currently available data; i.e., the standard and special components that exist for the span of the San Juan National Forest TMP. The salvable dead and the rough and rotten data were obtained from the San Juan National Forest Inventory 1966-67. This was the best information available. No down material was listed because INT-181 (the only source for down material) has these data only for lodgepole pine. This is illustrated in Table III-4. No dead material figures could be obtained from the TRIs or the Forestry Department of the Ute Reservation. These being the only two sources of information for state and private and reservation land, no data are listed in Table III-4 for these ownerships.

Salvable dead volumes on the Gunnison and GM-Unc National Forests are those volumes considered currently available. The percentage factors used to prorate the national forest data represent those portions of the national forests that are in the standard and special components. This assumes a homogeneous distribution of salvable dead material.

Volumes of naturally occurring down material are for lodgepole pine only. The Intermountain INT-181 publication inventoried down lodgepole pine volumes in Wyoming. These figures are the only down material data available at this time and represent currently available volumes. No lodgepole pine acreage was given for Delta, Ouray, Montrose, San Miguel and Hinsdale Counties, or for the Grand Mesa-Uncompahgre National Forests. Therefore, no down material figures were tabulated in these areas. Acreages of spruce-fir, however, were available for each county except Delta. The RM-125 report figures of 831 cubic feet/acre of standing and down dead spruce-fir was used to develop data for standing and down dead material.

The logging residue figures represent the amount of residue generated in one year based on the 1975 volume of timber sold, or the programmed annual cut. Intermountain publication INT-135 states that in Colorado 0.1043 of the cubic foot timber volume cut is left as logging residue. Tables III-5 and 6 list the programmed allowable cut.

Mortality information is from the TMPs for the national forests. The tabulated data relfect annual mortality that is currently available. The annual mortality information was multiplied by the same adjustment factors used for the salvable dead figures to determine currently available volumes. No annual mortality data were found for state and private lands.

Primary Wood Processors' Information

In Pagosa Springs we contacted Wolf Creek Industries and Day Lumber Co., both producers of house logs and siding. San Juan Lumber Company was also visited. San Juan Lumber Co. was not in production and had not been in November, 1974. Therefore, the data were the manager's best estimate based on immediately prior operations. In Montrose, Pryor Sawmill, Silver Tip Studs, Carr Lumber Co., and Lothlorein Fireplace Logs were queried. Carr Lumber Co. resawed lumber and made fireplace logs. Lothlorien used residue from Montrose to make fireplace logs. These two sources of information were not utilized in the tabulated data because they are not primary processors. However, their residues and by-products were counted. Montrose cost and value information was averaged with that of Pagosa Springs. To avoid disclosure of information the Table III-7 data were combined for the two sites.

The Forest Service's appraisal guide Timber Management Title 2400 Handbook, 7-74, was the source of data for the Forest Service's costs and values in Table III-8. Selling prices for lumber in the periodic supplement to the Title 2400 Handbook for November were supplied by the Region 2 office. The costs and values of chips and by-products are also given as regional averages in the Title 2400 Handbook. The Forest Service data on mill volumes processed were usually a gross approximation, if available at all, and therefore were not used. Instead, only the mills' production values are given in Table III-7.

The figures in Table III-8 were obtained using Forest Service guidelines in the Title 2400 Handbook. The values for fell and buck, skid, load, and overhead are Region 2 averages. These figures were adjusted with a factor that is applicable to each individual sale. Timber Management on the San Juan NF had no average adjustment factor whereas the Gunnison NF used 0.95 to adjust all figures, except hauling estimates.

The haul cost for Pagosa Springs was based on an average 35-mile haul one way. Timber Management on the San Juan NF supplied this mileage estimate. The Montrose area being much larger used a short haul of 31 miles one way and a long haul of

95 miles one way. The total stump to mill cost is an average that was determined using Forest Service guidelines. However, several variable factors such as slope and log size can change these values on each sale.

Potential Yield and Programmed Allowable Cut

Potential yield and programmed allowable cut are Forest Service terms. They are used because only the Forest Service has detailed future cut figures. State and private information is too scattered and too diverse to enable a determination of future cut plans.

The working papers for the TMPs were used to gather the future cut data for the national forests. Standard and special components were used to depict currently available timber. The total cut figures for the San Juan were adjusted by 0.182 to reflect the potential and annual cuts in the boundary area. This assumes equal cutting throughout the forest. The Gunnison data were used in their entirety, and the GM-Unc data were adjusted by 0.94 to get the cut figures.

State and private cut figures were based on what wood processors reported to be the average percent of their cut that came from state and private lands in the past 10 years. In both Pagosa Springs and Montrose only one mill at each site reported cutting timber from state and private land. Silver Tip Studs of Montrose cut 10 percent and San Juan Lumber in Pagosa Springs cut 5 percent from state and private sources. Although these figures may be only estimates by the managers they are the best available.

Based on the average 10-year history of state and private cutting we assumed potential cutting at the same percentage. The Ute Reservation cut figures were also based on previous cutting volumes. Data for the reservation came from the Timber Management unit on the San Juan National Forest. The prospective harvest volumes for Montrose and Pagosa Springs are presented in Tables III-5 and III-6, respectively.

References

1. Brown, Delmer. 1973-74. Private and State Timber Resources (vols.) Colorado State Forest Service, Colorado State University. Fort Collins, Colorado.

2. Brown, J. K. 1974. Reducing Fire Potential in Lodgepole Pine by Increasing Timber Utilization. USDA Forest Service Research Note INT-181, Ogden, Utah. pp. 1-6.

3. Miller, R. L., and G. A. Choate, 1964. The Forest Resources of Colorado, INT-3, Intermountain Forest and Range Experiment Station. Ogden, Utah.

4. Sampson, G. R., H. E. Worth, and D. M. Donnelly. 1974. Demonstration Test of Inwoods Pulp Chip Production in the Four Corners Region, RM-125. Rocky Mountain Forest and Range Experiment Station. Fort Collins, Colorado.

5. Setzer, T. S. 1973. Logging Residues on Harvesting Operations. Western South Dakota, Wyoming, Utah, and Colorado, INT-135. Intermountain Forest and Range Experiment Station. Ogden, Utah.

6. USDA Forest Service. 1974. Working Papers of Timber Management Plan: Gunnison National Forest. Region 2 Office; Denver, Colorado.

7. USDA Forest Service. 1974. Working Papers of Timber Management Plan: Grand Mesa - Uncompahgre National Forest. Region 2 Office; Denver, Colorado.

8. USDA Forest Service. 1974. Working Papers of Timber Management Plan: San Juan National Forest. Region 2 Office; Denver Colorado.

9. USDA Forest Service. Forest Survey Unit. Intermountain Forest and Range Experiment Station; Ogden, Utah.

10. USDA Forest Service. Timber Resource Review Update. Grand Mesa National Forest. Gunnison, Colorado.

11. USDA Forest Service. Stage I Inventories. Uncompahgre and Gunnison National Forests, Gunnison, Colorado.

12. USDA Forest Service. 1974. Title 2400 Timber Management, Region 2 Supplement No. 192. Region 2 Office; Denver Colorado.

Agencies Contacted for Information

1. USDA Forest Service. Supervisor's Office, Gunnison NF, Gunnison, Colorado.

2. USDA Forest Service. Supervisor's Office, San Juan NF, Durango, Colorado.

3. USDA Forest Service. Supervisor's Office, Uncompahgre NF, Delta, Colorado.

4. USDI Bureau of Indian Affairs. Forestry Department, Ignacio. Colorado.

Individuals Contacted for Information

1. Mr. John Pryor, Pryor Lumber Co., Montrose, Colorado.
2. Manager, Carr Lumber Co., Montrose, Colorado.
3. Manager, Lothlorien Fireplace Logs, Montrose, Colorado.
4. Manager, Silvertip Studs Co., Montrose, Colorado.
5. Mr. Troy Barker, Wolf Creek Industries, Pagosa Springs, Colorado.
6. Mr. Ray Dotson, San Juan Lumber Co., Pagosa Springs, Colorado.
7. Mr. Paul Day, Day Lumber Co., Pagosa Springs, Colorado.

Table III-1 . Living Raw Material Tributary to Montrose, Colorado

Geographic Location Information	Gunnison NF TMP 1974		Grand Mesa-Uncompahgre N F TMP 1972		Delta County TRI #17(1973)		Gunnison County TRI #18 (1974)	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber								
Spruce-fir type	75,617	169,473	44,800	131,250	N/A	N/A	11,800	36,020
Douglas fir-WF	13,062	11,560	2,121	6,048	N/A	N/A	11,400	16,672
Lodgepole	36,653	53,257	0	0	N/A	N/A	3,500	7,556
Ponderosa	0	0	13,995	13,604	N/A	N/A	700	646
Aspen	41,192	45,954	17,388	52,521	2,800	7,476	7,400	19,849
Total Sawtimber	166,524	280,244	78,304	203,423	2,800	7,476	34,800	80,743
Poletimber								
Spruce-fir type	6,100	3,128	4,241	11,634	N/A	N/A	17,300	40,320
Douglas-fir	863	68	0	0	N/A	N/A	7,600	9,948
Lodgepole	20,025	8,402	0	0	N/A	N/A	4,800	5,840
Ponderosa	0	0	1,484	420	N/A	N/A	N/A	n/A
Aspen	15,458	5,355	29,475	27,846	9,100	16,987	33,300	60,285
Total Poletimber	42,446	16,953	35,200	39,900	9,100	16,987	63,000	116,393
Seedlings & Saplings								
Spruce-fir type	6,907	2,598	1,272	210	N/A	N/A	N/A	N/A
Douglas-fir	10,890	6,839	0	0	N/A	N/A	N/A	N/A
Lodgepole	780	114	0	0	N/A	N/A	N/A	N/A
Ponderosa	0	0	1,484	N/A	N/A	N/A	N/A	N/A
Aspen	9,748	1,889	4,029	840	300	90	1,000	71
Total Seedlings and Saplings	28,325	11,440	6,785	1,050	300	90	1,000	71
Rough								
Softwood				19,885[1]				
Hardwood				17,846				
Total Rough	N/A	N/A	N/A	37,731	N/A	N/A	N/A	N/A
Rotten								
Softwood				16,484				
Hardwood				66,632				
Total Rotten	N/A	N/A	N/A	83,116	N/A	N/A	N/A	N/A

[1] Timber review of 1970 for Grand Mesa - Uncompahgre

Note: "N/A" signifies that certain information was not available at the time of this study. In some cases, total information was available, but individual data were not.

TABLE III-1 (2)

Geographic Location Information	Ouray County TRI #11 (1968)		Montrose County TRI #11 (1968)		San Miguel County TRI #11 (1968)		Hinsdale County TRI #18 (1974)	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber								
Spruce-fir type	2,500	8,370	3,900	14,488	3,300	13,384	670	2,435
Douglas-fir -WF	2,200	1,720	700	1,314	3,400	3,346	446	531
Lodgepole	0	0	0	0	0	0	0	0
Ponderosa	3,200	2,425	700	1,092	1,700	1,425	1,264	2,270
Aspen	7,000	17,397	7,100	20,437	8,640	23,109	74	348
Total Sawtimber	14,900	29,912	12,400	37,331	17,040	41,264	2,454	5,584
Poletimber								
Spruce-fir type	1,300	3,145	1,600	3,407	600	1,644	446	1,105
Douglas-fir	2,800	2,689	N/A	N/A	1,800	2,642	817	592
Lodgepole	0	0	0	0	0	0	0	0
Ponderosa	1,900	1,293	300	713	1,100	1,441	223	174
Aspen	18,200	32,704	11,200	24,735	20,520	41,806	1,040	1,709
Total Poletimber	24,200	39,831	13,100	28,855	24,020	47,533	2,526	3,580
Seedlings & Saplings								
Spruce-fir type			N/A					
Douglas-fir			N/A					
Lodgepole			N/A					
Ponderosa			N/A					
Aspen			700					
Total Seedlings & Saplings	N/A	N/A	700	N/A	N/A	N/A	N/A	N/A
Rough								
Softwood								
Hardwood								
Total Rough	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Rotten								
Softwood								
Hardwood								
Total Rotten	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE III-1 (3)

Geographic Location Information	Saguache County TRI #13 (1971)		Total of Table III-1 Living Mtl.	
	Acres	MCF	Acres	MCF
Sawtimber				
Spruce-fir type	1,350	3,608		
Douglas-fir	1,500	1,453		
Lodgepole pine	150	176		
Ponderosa	0	0		
Aspen	250	304		
Total Sawtimber	3,250	5,541	332,472	961,518
Poletimber				
Spruce-fir type	1,050	2,062		
Douglas-fir	1,050	1,039		
Lodgepole pine	800	1,060		
Ponderosa	0	0		
Aspen	2,050	2,619		
Total Poletimber	4,950	6,780	218,542	316,810
Seedlings & Saplings				
Spruce-fir type	N/A	N/A		
Douglas-fir	N/A	N/A		
Lodgepole Pine	100	13		
Ponderosa	N/A	N/A		
Aspen	550	89		
Total Seedlings & Saplings	650	102	37,760	12,753
Rough				
Softwood				
Hardwood				
Total Rough	N/A	N/A	N/A	37,731
Rotten				
Softwood				
Hardwood				
Total Rotten	N/A	N/A	N/A	83,116

Table III-2. Living Raw Material Tributary to Pagosa Springs, Colorado

Geographic Location / Source	San Juan N.F. TMP 1974		S.Ute Reservation Forest Inventory		Hinsdale County S&P TRI #18	Hinsdale County S&P TRI #13	Mineral County S&P	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber								
Spruce-fir	15,445	57,839	N/A	N/A	71	259	118	350
Pinon-Juniper	N/A	N/A	11,226	N/A	N/A	N/A	N/A	N/A
Douglas-fir-WF	7,883	15,525	942	1,333	47	56	68	57
Ponderosa pine	7,682	9,251	5,043	4,899	134	241	37	124
Aspen	2,654	5,550	30	64	8	37	31	45
Total Sawtimber	33,664	88,165	17,241	6,296 1/	260	593	254	576
Poletimber								
Spruce-fir	442	603			47	117	87	158
Douglas-fir-WF	361	643			87	63	31	48
Ponderosa pine	0	0			24	18	0	0
Aspen	4,786	7,561			111	182	112	220
Total Poletimber	5,589	8,807	N/A	N/A	269	380	230	426
Seedlings & Saplings								
Spruce-fir	402	522						
Douglas-fir-WF	160	120						
Ponderosa pine	0	0						
Aspen	965	442						
Total Seedlings & Saplings	1,527	1,084	N/A	N/A	N/A	N/A	N/A	N/A
Rough								
Softwood		1,287						
Hardwood		482						
Total Rough	N/A	1,769	N/A	N/A	N/A	N/A	N/A	N/A
Rotten								
Softwood		1,407						
Hardwood		3,499						
Total Rotten	N/A	4,906	N/A	N/A	N/A	N/A	N/A	N/A

Note: "N/A" signifies that certain information was not available at the time of this study. In some cases total information was available, but individual data were not.

1/ Sawtimber on Ute Reservation is min. 12 inches dbh.

TABLE III-2 (2)

Geographic Location Source	Archuleta County S&P TRI #9		Total of Table III-2 Living Mtl.	
	Acres	MCF	Acres	MCF
Sawtimber				
Spruce-fir	3,994	16,526		
Pinon-Juniper	N/A	N/A		
Douglas-fir-WF	4,692	8,426		
Ponderosa pine	9,130	8,869		
Aspen	2,980	6,292		
Total Sawtimber	20,796	40,113	72,215	135,743 1/
Poletimber				
Spruce-fir	2,282	4,503		
Douglas-fir-WF	3,424	5,127		
Ponderosa pine	9,700	10,877		
Aspen	7,671	19,522		
Total Poletimber	23,077	40,029	29,165	49,642
Seedlings & Saplings				
Spruce-fir				
Douglas-fir-WF				
Ponderosa pine				
Aspen				
Total Seedlings & Saplings	N/A	N/A	1,527	1,084
Rough				
Softwood				
Hardwood				
Total Rough	N/A	N/A	N/A	1,769
Rotten				
Softwood				
Hardwood				
Total Rotten	N/A	N/A	N/A	4,906

Table III-3. Dead Raw Material Tributary to Montrose, Colorado

Geographic Location	Gunnison NF	Grand Mesa-Uncompahgre NF	Delta	Gunnison	Ouray	Montrose	San Miguel	Hinsdale	Saguache
	MCF	MCF	MCF	MCF	MCF	MCF	MCF	MCF	MCF
Standing Salvable Dead									
Spruce-fir type	16,336[1]			24,179[3]	3,157[3]	4,569[3]	3,240[3]	927[3]	1,994[3]
Douglas-fir	584								
Lodgepole pine	5,402	5,044[2]							
White pine	73								
Aspen	2,033	1,125							
Total Standing	24,428	6,169	N/A	24,179	3,157	4,569	3,240	927	1,994
Down									
Spruce-fir type									
Douglas-fir									
Lodgepole pine	47,403			6,847					866
Ponderosa pine									
Aspen									
Total Down	47,403	N/A	N/A	6,847	N/A	N/A	N/A	N/A	866
Logging Residues									
Spruce-fir type									
Douglas-fir									
Lodgepole pine									
Ponderosa pine									
Aspen									
Total Logging Residue /yr	132	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Annual Mortality									
Spruce-fir type	576	852							
Douglas-fir	16	32							
Lodgepole pine	544	0							
Ponderosa pine	0	69							
Aspen	208	280							
Total Annual Mortality	1,344	1,233	N/A	N/A	N/A	N/A	N/A	N/A	N/A

[1] Based on 1970 Timber Review by Forest

[2] Value for softwoods only for Grand Mesa

[3] All SF salvable dead is for salvable dead and down dead material from RM-125 using 831 cu.ft./acre.

Note: "N/A" signifies that certain information was not available at the time of this studv.

Table III-4. Dead Raw Material Tributary to Pagosa Springs, Colorado

Geographic Location	San Juan N.F. MCF	State and Private MCF	Ute Reservation MCF
Standing Salvable Dead			
Spruce-fir		5,483[1]	
Douglas-fir -WF	282		
Ponderosa			
Aspen	161		
Total Standing	443	5,483	N/A
Down			
Spruce-fir			
Douglas-fir - WF			
Ponderosa			
Aspen			
Total Down	N/A	N/A	N/A
Logging Residues			
Spruce-fir			
Douglas-fir - WF			
Ponderosa			
Aspen			
Total Logging Residue/yr	106	37	42
Annual Mortality			
Spruce-fir	221		
Douglas-fir - WF	149		
Ponderosa	0		
Aspen	125		
Total Annual Mortality	495	N/A	N/A

Note: "N/A" signifies that certain information was not available at the time of this study. In some cases total information was available, but individual data were not.

1/ From total live S-F acres on S & P land, RM-125 @ 831 cuft/acre.

Table III-5. Potential Yield & Programmed Allowable Cut for Pagosa Springs, Colroado

Geographic Location	San Juan N.F.[1]		State & Private		Ute Reservation	
	Acres	Sawtimber MCF	Acres	Sawtimber MCF	Acres	MCF
Potential Yield (10 years)						
Standard	16,616	10,143				
Special	1,747	690				
Total	18,363	10,833	N/A	N/A	N/A	N/A
Programmed Allowable Cut						
Standard		N/A				
Special						
Total	N/A	1,019	N/A	350[2]	N/A	400[3]

Note: "N/A" signifies that certain information was not available at the time of this study. In some cases total information was available, but individual data were not.

1/ Working papers of TMP only

2/ Base: one mill's data

3/ Estimated by Timber Mgmt. on San Juan N.F.

Table III-6. Potential Yield and Programmed Allowable Cut for Montrose, Colorado.

Geographic Location	Grand Mesa - UNC.[1]		Gunnison[2]		Combined State & Private	
	Acres	Sawtimber MCF	Acres	Sawtimber MCF	Acres	Sawtimber MCF
Potential Yield (10 years)						
Standard	36,566	25,371	55,000	31,240		
Special	4,700	3,450	12,000	3,170		
Total	41,266	28,821	67,000	34,410	N/A	N/A
Programmed Allowable Cut						
Standard	6,298	3,102	2,800	1,270		
Special	282	56				
Total	6,580	3,158	2,800	1,270	N/A	270[3]

Note: "N/A" signifies that certain information was not available at the time of this study. In some cases total information was available, but individual data were not.

[1] Grand Mesa and Uncompahgre 1974 TMP

[2] Gunnison 1974 TMP

[3] Based on one mill's data

Table III-7. Combined Production Data for Montrose and Pagosa Springs, Colorado as of November, 1974

1.	Input to Mills for - Lumber	62 MMBF
	House logs and siding	2.5 MMBF
2.	Avg. Value of Product FOB mill	
	Lumber	$116/MBF
	House logs & siding	$200/MBF
3.	Avg. Milling costs	
	Lumber	$44.25/MBF
	House logs and siding	$27.50/MBF
4.	Avg. Raw Mt'l. Costs to mill	
	Lumber	$54.50/MBF
5.	Residue volumes	Utilization
	chips 13,800 units/yr	pulp
	shavings, sawdust, bark } 48,000 units/yr	burned or stored; burned or diverted to a secondary product producer as a disposal item
6.	Avg. cost of by-products & residues	$17.50/unit (chips)
7.	Avg. value of by-products or residues	
	chips	$28.00/unit
	sawdust, bark	$ 9.42/unit[1/]
8.	Species used	ES, DF, PP, WF, Corkbark fir, Aspen, Dead ES

1/ Estimated by authors. Compared with coal -- an unregulated energy source as to price -- on the basis of equivalent thermal content and with coal valued at $0.69/MM BTU, hogged residue fuel would be valued at $9.42 per unit.

Table III-8. U.S. Forest Service Estimates of Production Data for the Central Rockies Portion of Region 2[1/]

1. Primary Product Value for Lumber/MBF	$125.65 - ES & Corkbark Fir 182.39 - PP 132.13 - DF 120.26 - WF
2. Milling Costs lumber/MBF	$ 73.18 except aspen
3. Avg. raw material costs to the Mill/MBF	$ 10.60 - Fell & Buck 15.80 - Skid 5.30 - Load 7.28 - Overhead $ 28.98/MBF
Avg. Haul costs/MBF	Montrose: $10.92 (for 31 miles one way) 32.84 (for 95 miles one way) Pagosa Springs: $24.50 (for 35 miles one way)
4. Costs Associated with Residues[2/]	$ 3.20/unit L.S. chips 0.19/unit L.S. by-products
5. Value of Residues[2/]	$ 3.74/unit L.S. chips 0.34/unit L.S. by-products

[1/] Title 2400 - Timber Management Region 2

[2/] Costs and values of residues per number of units generated in the processing of 1 MBF log scale of sawlogs.

Table III-9. Average Product Costs and Values for Montrose and Pagosa Springs, Colorado.

	Lumber	House Logs and Siding
Value FOB mill	$116/MBF	$200/MBF
Milling Cost	($ 44.25/MBF)	($ 27.50/MBF)
Raw Material Cost	($ 54.50/MBF)	N/A

Note: "N/A" signifies that certain information was not available at the time of this study.

CASE STUDY IV: RESERVE AND ESPAÑOLA, NEW MEXICO

Summary

The Española site has 156,800 MCF of living raw material in the boundary. For the Reserve tributary area 232,750 MCF of living raw material was found to be available. The living material data for both of the New Mexico sites are based on the U. S. Forest Service's Timber Inventory. Since this information has not yet been incorporated into a timber management plan (TMP), it is subject to change before final approval of the TMP. Acreage data for the Gila NF was adequate but it, too, could be changed when the TMP is adopted. Final approval of a TMP is subject to many revisions so the reported acreages and volumes on the national forests can change from those used in this report. However, the data in this report reflect the best available information that can be determined for live timber in the two boundaried areas.

Total standing dead material for the Española boundary was 2,920 MCF and correspondingly 794 MCF for the Reserve site. The Intermountain Station supplied the national forest salvable dead estimates, except for the Gila NF. These figures were prorated into the boundary area to represent the currently available volumes. This, of course, tends to lessen somewhat the credibility of the figures. It was estimated that the Española site had 11,130 MCF of down dead material while 1,170 MCF were estimated for the Apache NF in the Reserve boundary. These figures were developed from the RM-125 figure for standing and down dead material. Since there was no way to separate standing from down dead spruce the estimates contain an undetermined amount of standing dead material. Thus the figures in Tables IV-3 and 4 for down dead are questionable.

Logging residues of 250 MCF were determined for the Española site and 1,160 MCF for Reserve. If the projected annual cuts for 1975 in Tables IV-5 and 6 are met, and the logging residues generated are those predicted in INT-78, then the tabulated residue figures will be reliable.

Total annual mortality figures were found for the national forests except the Carson NF and state and private land. These figures were 330 MCF for the

Santa Fe NF in Española's boundary and 450 MCF for the Reserve site. The standard and special component volumes were prorated into the boundary from national forest data. Prorating these estimates, of course, reduces their reliability.

For both Española and Reserve the total volume supplied to the mills was 45.5 MMBF for lumber and 2308 cords of poles. The managers and/or owners of the wood-using industries at each site related this information personally. They also estimated that 15,450 units/year of chips were generated and that 7,500 units/year of bark, sawdust, shavings, etc. were produced. The managers visited were able to give volumes for either chips or sawdust, bark, shavings, etc., but not for both.

From the contacts, average production costs and values were also obtained. Production costs included costs delivered to the mill and manufacturing costs. These amounted to an average of $92/MBF for lumber. Average product value of lumber for the two mills was $137.50/MBF for the November 1974 period.

The estimates of Forest Service costs and values are regional averages for November 1974. The stump to mill costs in Table IV-9 are from general Forest Service guidelines but in no way reflect any individual sale.

Since no TMPs were available for any of the four national forests in this case study, it may not be assumed that the potential or programmed cut estimates in Tables IV-5 and IV-6 are final. Further, the unavoidable prorating of the figures into the boundary areas tends to lessen their reliability.

Introduction

Reserve and Española were aggregated in this case study to avoid possible disclosure of confidential information. This grouping was especially important in this case because each of these sites has only one primary processor of wood raw material. Area and resource volume data are presented for each site separately. It is the private processors' information that is aggregated.

Reserve, New Mexico is in west central New Mexico. Southwest Forest Industries is the only primary processor of timber products at this site. Rough lumber is cut at the mill and sent to Eagar, Arizona for further processing. Reserve is within the bounds of the Gila National Forest (NF). The

Apache NF is to the north as is shown in Fig. IV-1. Both of these forests supply the mill with raw material. Ponderosa pine accounts for 95% of the mill's cut, while 5% is true fir. Subalpine, corkbark, and white fir are included in the true-fir classification. Reserve has access to U. S. Highway 180 as well as New Mexico State Highway 12.

Española is in the north central part of New Mexico just to the north of Santa Fe. Duke City Lumber is the primary processor of wood at this site. Dimension and board lumber are produced by the mill. From Figure IV-2 one can see that the Santa Fe NF and Carson NF are tributary to the Española site. The mill at Española currently utilizes ponderosa pine, true fir, and Engelmann spruce. Española has access to U. S. Highways 84, 285, and 64 as well as New Mexico State Highways 76 and 5. Rail service is provided by the Santa Fe railroad.

Four national forests lie within the bounds of these two processing sites: Carson, Santa Fe, Apache, and Gila. None of the individual forest data was used in total because the boundaries developed in Figures IV-1 and IV-2 did not cover an entire forest. Therefore, it was necessary to develop a boundary adjustment factor to prorate the available forest data into the boundary area. Volume and area data were multiplied by the respective boundary adjustment factors to estimate the volumes and areas within the boundary of the tributary area for each site.

State and private (county) data were provided by the New Mexico Department of Forestry. A boundary adjustment factor was also developed for each county in the two boundaries since no county was entirely within either of the tributary areas.

An availability adjustment factor was developed to reflect the areas and volumes that are considered currently available. This was accomplished by using Environmental Impact Statements (EIS) to determine what percent of each national forest was made up of standard and special components. No EIS was available for the Gila NF; therefore, data for that forest were adjusted by the boundary factor only. The percent of the special and standard components within each national forest multiplied by the areas and volumes in the boundary yields the current amount of available materials.

Figure IV-1. Area tributary to Reserve, NM.

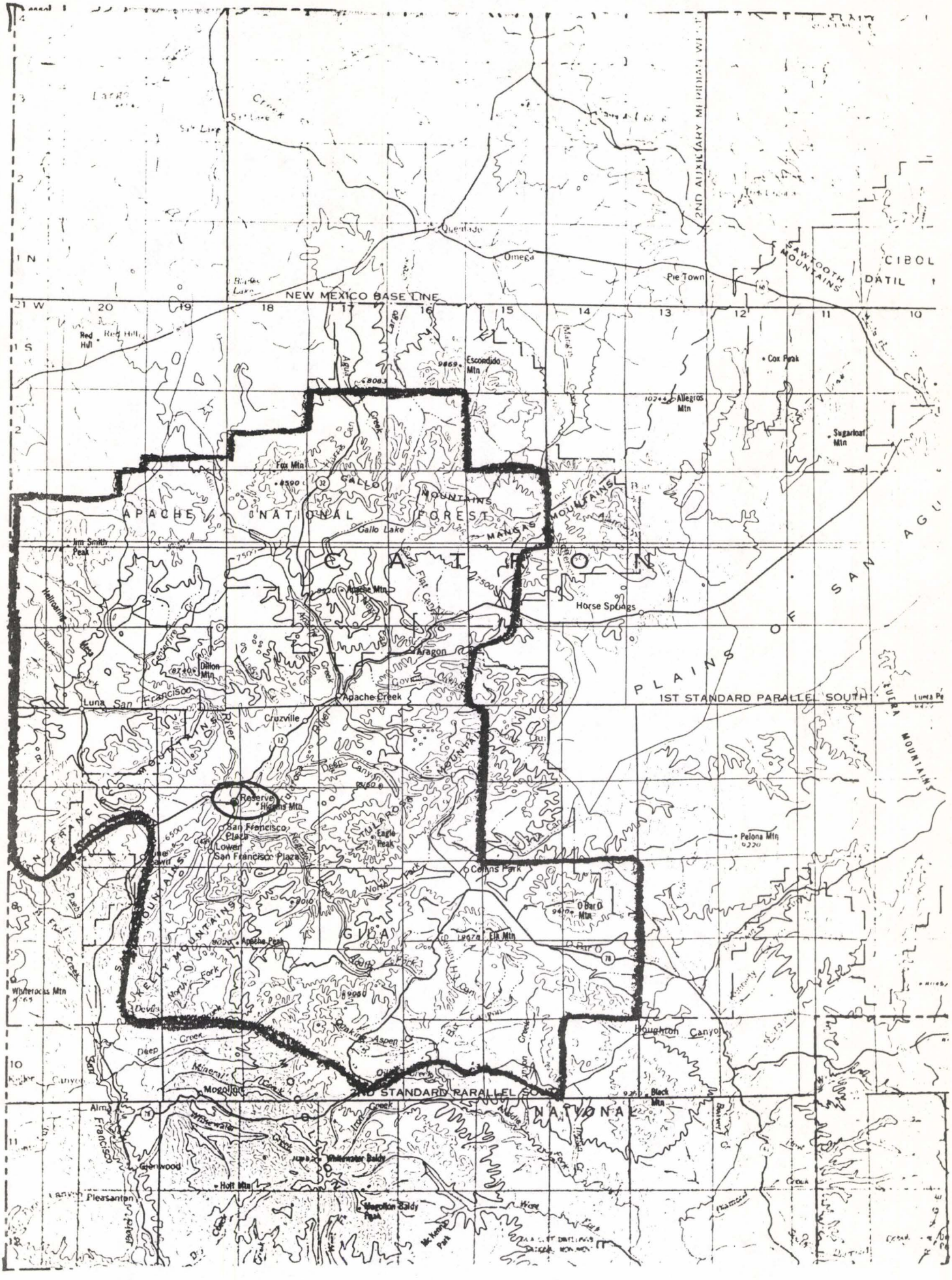
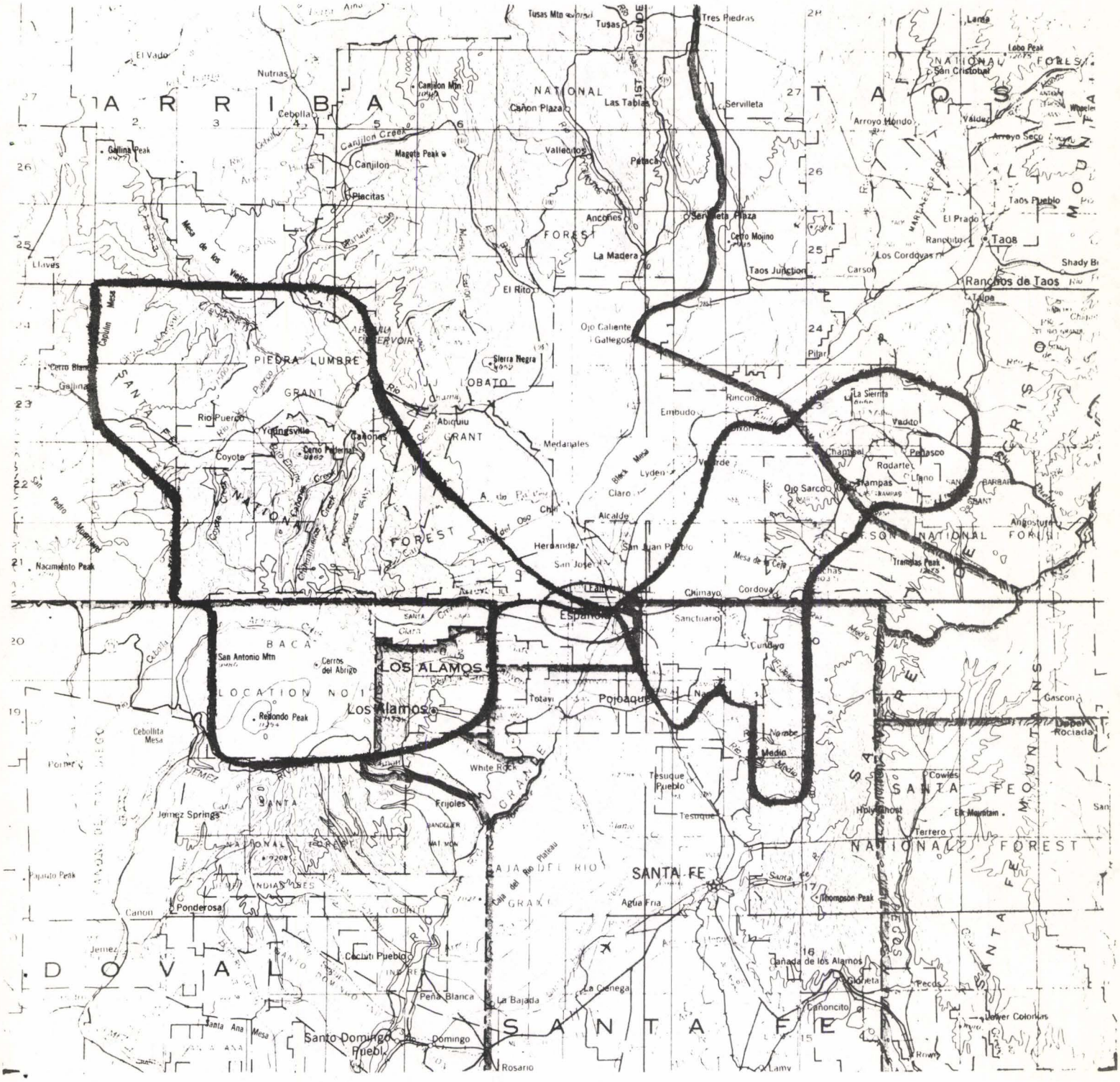

NEW MEXICO BASE LINE
1ST STANDARD PARALLEL SOUTH
2ND STANDARD PARALLEL SOUTH
APACHE NATIONAL FOREST
GALLO MOUNTAINS
MANGAS MOUNTAINS
PLAINS OF SAN AGUSTIN
GILA
Omega
Pie Town
Escondido Mtn
Cox Peak
Allegros Mtn
Sugarloaf Mtn
Fox Mtn
Gallo Lake
Jim Smith Peak
Apache Mtn
Horse Springs
Aragon
Dillon Mtn
Apache Creek
Luna
Cruzville
Reserve
Hignis Mtn
San Francisco Plaza
Lower San Francisco Plaza
Eagle Peak
Pelona Mtn
Cohns Park
O Bar O Mtn
Whitetail Peak
Whitetail Baldy
Holt Mtn
Pleasanton
Aspen
Houghton Canyon
Black Mtn
Red Hill
Red Hill
Quemado
Sawtooth Mountains
Cibola
Datil
Luna Peak
Mogollon
Alma

Figure IV-2. Area tributary to Española, NM.


A R R I B A
T A O S
D O N A
S A N T A F E
NATIONAL FOREST
PIEDRA LUMBRE
GRANT
LOBATO
LOS ALAMOS
Los Alamos
Española
Poeoaque
SANTA FE
Tres Piedras
Tusas
Servilleta
Las Tablas
Cañon Plaza
Vallecitos
Petaca
Arroyo Hondo
Taos Pueblo
El Prado
Taos
Ranchos de Taos
Los Cordovas
Taos Junction
La Madera
Ancones
Cerro Mojino
El Rito
Ojo Caliente
Gallegos
Sierra Negra
Rinconada
La Sierrita
Vadito
Chamisal
Penasco
Rodarte
Ojo Sarco
Stampas
Llano
Barbar
Angostura
Tranchas Peak
Embudo
Medanales
Abiquiu
Rio Puerco
Youngsville
Canones
Cerro Pedernal
Coyote
Nacimiento Peak
Herandez
San Juan Pueblo
San Jose
Chimayo
Cordova
Sanctuario
Cundiyo
Totavi
Nambe
Medio
Tesuque Pueblo
Tesuque
Cowles
Holy Ghost
Terrero
Gascon
Rociada
Pecos
Cañoncito
Lower Colonias
Canoncito
La Cienega
La Bajada
Agua Fria
Thompson Peak
Cañada de los Alamos
Glorieta
Santa Fe
White Rock
Frijoles
Jemez Springs
Ponderosa
Cebolla
Nutrias
El Vado
Canjilon
Canjilon Mtn
Placitas
Maggie Peak
Gallina Peak
Llaves
Cerro Blanco
Gallina
Rio Puerco
Coyote
Cebollita Mesa
Redondo Peak
San Antonio Mtn
Cerros del Abrigo
Peña Blanca
Cochiti Pueblo
Santo Domingo Pueblo
Domingo
Rosario
Santa Ana Mesa
Pajarito Peak
Lobo Peak
San Cristobal
Arroyo Seco
Shady Brook
Tusas Mtn
Cebolla
Canjilon Creek
Mesa de los Viejos
Capulin Mesa
Santa Fe
Rio Chama
Abiquiu
Rio Ojo Caliente
Rio del Oso
Rio Gallina
Rio Puerco
Rio Jemez
Rio Grande
Rio Medio
Rio Nambe
Caja del Rio Plateau
Mesa de la Ceja
Black Mesa
Pedro Mountains
Jemez Mountains
Sangre de Cristo Mountains
Santa Fe Mountains
1ST GUIDE
Carson
Valdez
Lyden
Claro
Alcalde
Pilar
Talpa
Shady Br
Angostura
Gascon
Rociada
Dobel
Cebollita Mesa
Ponderosa Canon
Jemez
Santa Ana Mesa
Rosario
Lamy
Rowe
Glorieta
Pecos
Cañoncito
Lower Colonias
Thompson Peak
Agua Fria
Santa Fe
Tesuque
Tesuque Pueblo
Holy Ghost
Terrero
Cowles
Medio
Nambe
Totavi
Poeoaque
Cundiyo
Sanctuario
Chimayo
Cordova
Española
San Juan Pueblo
San Jose
Herandez
Medanales
Abiquiu
Rio Puerco
Youngsville
Canones
Cerro Pedernal
Coyote
Nacimiento Peak
Ojo Sarco
Stampas
Llano
Barbar
Angostura
Tranchas Peak
Rodarte
Penasco
Chamisal
Vadito
La Sierrita
Rinconada
Embudo
Ojo Caliente
Gallegos
Sierra Negra
Pilar
Talpa
Ranchos de Taos
Taos
Taos Pueblo
El Prado
Los Cordovas
Taos Junction
Carson
La Madera
Ancones
Cerro Mojino
El Rito
Servilleta
Las Tablas
Cañon Plaza
Vallecitos
Petaca
Tres Piedras
Tusas
Tusas Mtn
Arroyo Hondo
Arroyo Seco
Lobo Peak
San Cristobal
Valdez
Shady Brook
Canjilon
Canjilon Mtn
Canjilon Creek
Maggie Peak
Placitas
Gallina Peak
Llaves
Cebolla
Nutrias
El Vado
Cerro Blanco
Gallina
Rio Puerco
Coyote
Youngsville
Canones
Cerro Pedernal
Abiquiu
Rio Chama
Rio Ojo Caliente
Rio del Oso
Rio Gallina
Rio Puerco
Rio Jemez
Rio Grande
Rio Medio
Rio Nambe
Caja del Rio Plateau
Mesa de la Ceja
Black Mesa
Pedro Mountains
Jemez Mountains
Sangre de Cristo Mountains
Santa Fe Mountains
1ST GUIDE
Carson
Valdez
Lyden
Claro
Alcalde
Pilar
Talpa
Shady Br
Angostura
Gascon
Rociada
Dobel
Cebollita Mesa
Ponderosa Canon
Jemez
Santa Ana Mesa
Rosario
Lamy
Rowe
Glorieta
Pecos
Cañoncito
Lower Colonias
Thompson Peak
Agua Fria
Santa Fe
Tesuque
Tesuque Pueblo
Holy Ghost
Terrero
Cowles
Medio
Nambe
Totavi
Poeoaque
Cundiyo
Sanctuario
Chimayo
Cordova
Española
San Juan Pueblo
San Jose
Herandez
Medanales
Abiquiu
Rio Puerco
Youngsville
Canones
Cerro Pedernal
Coyote
Nacimiento Peak
Ojo Sarco
Stampas
Llano
Barbar
Angostura
Tranchas Peak
Rodarte
Penasco
Chamisal
Vadito
La Sierrita
Rinconada
Embudo
Ojo Caliente
Gallegos
Sierra Negra
Pilar
Talpa
Ranchos de Taos
Taos
Taos Pueblo
El Prado
Los Cordovas
Taos Junction
Carson
La Madera
Ancones
Cerro Mojino
El Rito
Servilleta
Las Tablas
Cañon Plaza
Vallecitos
Petaca
Tres Piedras
Tusas
Tusas Mtn
Arroyo Hondo
Arroyo Seco
Lobo Peak
San Cristobal
Valdez
Shady Brook
Canjilon
Canjilon Mtn
Canjilon Creek
Mesa de los Viejos
Capulin Mesa
Santa Fe
Rio Chama
Abiquiu
Rio Ojo Caliente
Rio del Oso
Rio Gallina
Rio Puerco
Rio Jemez
Rio Grande
Rio Medio
Rio Nambe
Caja del Rio Plateau
Mesa de la Ceja
Black Mesa
Pedro Mountains
Jemez Mountains
Sangre de Cristo Mountains
Santa Fe Mountains
1ST GUIDE

Comparable figures for standard and special components are not available for New Mexico state and private forest land. However, area and volume figures are for commercial forest land (CFL). The boundary adjustment factor is applied to these figures to find the state and private CFL within the boundaries of the two sites. This assumes that CFL is evenly distributed throughout a county.

Living Raw Material

This section describes the information in Tables IV-1 and IV-2 for both sites. The subheadings are those used in the taxonomy that was developed for this project.

Española

An attempt was made to gather as much data as possible for living material in the Española boundary area. The boundary was drawn by the Region 3 Forest Service office in Albuquerque. This boundary was later revised by the Timber Management specialists on the Santa Fe NF. The boundary is depicted in Figure IV-2. Both the Carson and Santa Fe National Forests are tributary to Española.

The Carson NF volume information was obtained from the Region 3 office in Albuquerque. The volumes were gathered from the Carson NF Timber Inventory[1/]. Inasmuch as only part of the Carson NF was in the boundary tributary to Española, a boundary adjustment factor was used to prorate volume information into our boundary. The Timber Inventory's volume data were for growing stock on the national forest. Once the growing stock volume had been prorated into the boundary it was necessary to apply the availability adjustment factor. The availability factor prorated standard and special components into the boundary. This, of course, assumes that these two components are evenly distributed over the forest. The volume figures thus obtained represent volumes currently available within the boundary for the Carson NF.

Timber Inventory data listed only volumes on the Carson NF. To find acreage data for these volumes, average volume/acre figures were developed from

1/ Timber Inventories were made available by Region 3 headquarters in Albuquerque.

New Mexico's Forest Resource (INT-5). Volume/acre figures, for species and stand-size class, are averages for the State of New Mexico and therefore are not for the Carson NF exclusively. Neither volume nor area figures were found for seedlings and saplings.

Estimates of rough timber were made from figures supplied by the Forest Survey unit of the Intermountain Station, Ogden, Utah. There was no data available on rotten timber. The data on rough timber reflect that volume within the boundary of the Carson NF that is currently available.

Volume information for the Santa Fe NF was also obtained from the Region 3 Forest Service office. This too, was Timber Inventory data for the national forest. It was necessary to use both boundary and availability adjustment factors to prorate the forest's currently available volume of growing stock into the boundary. Areas by type and stand-size class were determined for the Santa Fe NF as they were for the Carson NF using average volumes/acre. Again, seedling and sapling data were not available.

Rough and rotten data for the Santa Fe NF are volumes considered currently available (prorated from Forest Survey data) within the boundary. Areas of rough and rotten timber were not available for either the Santa Fe or Carson National Forests.

State and private timber data were found for each county in the boundary except for Los Alamos County. As mentioned in the introduction, areas and volumes of state and private lands were prorated into boundary areas for both sites. No description by species or stand-size class was available. Therefore, a "Total Growing Stock" subheading is introduced into Tables IV-1 and IV-2 for the two New Mexico sites. This was done because areas and volumes of timber were presented for total commercial forest land and not for species and stand-size class used in other case studies. To keep this new subheading consistent for the two sites the national forests were also totaled vertically.

Another source of data examined for the living material classification was the Forest Survey information supplied by the Intermountain Station. These data were generally not as recent as the sources of data that were ultimately used. However, when no other information was available (as in the case of rough and rotten timber) Forest Survey data were used. New Mexico's Forest

Resource (INT-5) was also outdated and on too large a scale (the entire state) to be of any value, except to estimate volumes/acre.

Reserve

Reserve's boundary was drawn by the Region 3 office of the U. S. Forest Service and is depicted in Figure IV-1. The Timber Inventory volume data for the Gila NF were obtained from Region 3 headquarters. The two northernmost ranger districts of the Apache NF are also managed along with the Gila NF. Timber Inventory volume data were available for the Apache NF. It was understood, however, that the two Apache NF ranger districts were inventoried in the Apache Timber Inventory. Thus, the Apache data are presented separately from the Gila because of the two different sources of volume information.

The Gila NF volume data are for growing stock prorated into the boundary. As stated in the introduction, no EIS was available from which to develop an availability adjustment factor. However, Gila NF volume and area data were available by special and standard components. Therefore, the area and volume data multiplied by the boundary adjustment factor represent currently available areas and volumes in the boundary. This assumes that the special and standard components are evenly distributed throughout the Gila NF. Seedling and sapling data were not available.

Rough and rotten data for Gila NF commercial forest land were, again, estimated from figures supplied by the Intermountain Station. Since no availability factor could be developed, the rough and rotten timber in the volume on commercial forest land within the site boundary.

The Apache NF Timber Inventory supplied growing stock volumes. The volumes were adjusted by a boundary adjustment factor and an availability factor to find the volumes considered currently available within the boundary.

Apache NF acreages within the boundary were prorated from the Gila NF acreage data that were mentioned earlier. In this case it was understood that the Gila NF acreage data, by type and stand-size class, included the two Northern districts of the Apache NF. Since these data were presented by special and standard components, only a boundary adjustment factor was used to estimate the acreages presented in Table IV-2. This, of course, assumes an equal distribution of standard and special components throughout the Gila NF.

Rough and rotten timber volumes from the Intermountain Station are presented as those which are currently available in the boundary areas of the Apache NF.

Only one county, Catron, is in the boundary area for Reserve. County data are estimated in the same manner as county data for Española using a boundary adjustment factor. Only total CFL areas and volumes were available.

The same sources as in the Española study were perused for living material information. The sources used for areas and volumes represent the best available information for these sites.

Dead Raw Material

This section of the report describes the collection of data for Tables IV-3 and IV-4. Generally, there was much less information available in the dead material category than for the living.

Salvable dead figures were obtained from the Intermountain Station. These were available for the Carson, Santa Fe, and Apache National Forests, but not for the Gila NF. The figures were prorated to reflect the volumes in the two boundaries that are considered to be currently available by using both boundary ary and availability adjustment factors. No state and private estimates were available for the standing (salvable) dead. No other sources were found which had this information.

Down dead figures were projected by using only the spruce-fir type. On the basis of the RM-125 publication, 831 cubic feet/acre of spruce-fir material is standing or down dead material. Therefore, this figure applies to both salvable and down dead but is presented only in the down category. Intermountain Station estimates were available for salvable dead for all national forests (preceding paragraph) except the Gila NF. The Gila NF, then, has only the spruce-fir estimate for salvable or down dead material. The estimate of spruce-fir down material is the only information available for the down dead subheading. Since the RM-125 estimates aggregate both salvable and down dead material, they are larger than the salvable dead volumes from the Intermountain Station.

Tables IV-5 and IV-6 depict the volume of timber to be harvested annually (1975) while the INT-78 publication determines that 12.18% of the harvested volume is left as logging residue in New Mexico. These logging residue figures are currently available because by definition only the standard and special components are harvested. State and private logging residues were developed using the percentage factor above with the volume of timber harvested in the past from state and private land. The potential yield and annual cut section details annual harvest information for national forest and state and private land.

Mortality figures were derived from the Timber Inventories for each national forest. The volumes given represent the currently available annual mortality for each species in the boundary area. Carson NF mortality data were not found.

Primary Wood Processors' Information

Table IV-7 lists production information obtained from the industries at the two sites. Their production figures have been aggregated to avoid disclosing any one source of information. Costs and values are applicable to the November, 1974 time period.

Production data for lumber and residues produced are shown as totals. Cost and value information was averaged. The production of poles by one mill is to be terminated in 4-5 years, since the poletimber material will be completely exhausted. No other data were available concerning pole production from the mill. Only one mill's report was available for the volumes of chips, sawdust, bark and shavings generated. Chips at both sites were sent to the pulp mill in Snowflake, Arizona. Española sent shavings to a particleboard plant located near Albuquerque. Table IV-8 lists the costs and values of lumber production for the two sites.

Table IV-9 was developed using information supplied by the Forest Service Region 3 office. The Region 3 Timber Management office uses these figures, as regional averages, in developing timber appraisals. The values reflect the lumber values that existed about November of 1974. Milling cost is a regional average. The costs for fell and buck, skid, load, and overhead are also

regional averages. The haul costs were estimated using approximate haul distances for the two sites, which were supplied by the Region 3 office. This office also suggested an average regional haul cost of $0.25/mile/MBF. Stump-to-mill costs are quite close to the average costs estimated by the industries. These costs, however, may vary by individual sale. These were the only Forest Service production figures available to the investigators.

Potential Yield and Programmed Allowable Cut

Tables IV-5 and IV-6 depict the potential and annual cut acreages and volumes. These values were estimated for the boundary areas using the EIS for each forest. Therefore, these values are subject to revision as the EIS is only a proposal for a Timber Management Plan.

The proposed sell on the Gila NF was taken from a Region 3 report (2400-26B) that listed annual potential yields, by components, for the region. Annual potential is used here as the annual programmed cut on the Gila NF. This figure was multiplied by 10 to get the potential 10-year yield. No acreages were available; only the volumes to be cut. Therefore, a rough estimate of 1500 cubic feet/acre was developed from New Mexico's Forest Resource (INT-5). This estimate, divided into the total volumes to be cut, roughly determines acreages for future cutting. No better information was available for the acreages and volumes to be cut.

The other three national forest's acreages and volumes were prorated (by boundary adjustment factors) into the two boundaries from EIS information. The Carson NF figures are for the period 1974-1978; Santa Fe NF data are for 1975 to 1977, while the Apache NF figures are for 1974-1983. Data in Figure IV-1 indicate that much more of the Gila NF than of the Apache NF is in the boundary. Table IV-6, however, notes that more timber will be cut from the prorated area of the Apache[1/] than from the Gila NF. This is because the Apache NF's total proposed cut is over twice that of the Gila NF total proposed cut according to Forest Service figures.

1/ The Apache's potential yield is prorated from the entire national forest data. The annual cut is from the two New Mexico ranger districts of the Apache.

State and private cuts were determined from industry records. It was assumed that the average annual cut from state and private land for the past 10 years would again be cut in 1975 and subsequent years. No timber from state and private land is cut by the mill in Reserve.

References

1. Choate, Grover, A. 1966. New Mexico's Forest Resource. Intermountain Forest and Range Experiment Station (INT-5). Ogden, Utah.

2. New Mexico Department of State Forestry. State and Private Forest Volumes. Department of State Forestry. Santa Fe, New Mexico.

3. Setzer, T. S., Wilson, A. K. and Choate, G. A. 1970. Logging Residues on Sawlog Operations, Arizona and New Mexico (INT-78). Intermountain Forest and Range Experiment Station. Ogden, Utah.

4. USDA Forest Service. 1973. Environmental Statement - Apache National Forest. Region 3 Forest Service. Albuquerque, New Mexico.

5. USDA Forest Service. 1973. Environmental Statement-Santa Fe National Forest. Region 3 Forest Service. Albuquerque, New Mexico.

6. USDA Forest Service. 1973. Environmental Statement-Carson National Forest. Region 3 Forest Service. Albuquerque, New Mexico.

7. USDA Forest Service. 1972. Timber Inventory (Apache, Carson, Gila, Santa Fe National Forests) Region 3 Forest Service. Albuquerque, New Mexico.

8. USDA Forest Service. Forest Survey Unit. Intermountain Forest and Range Experiment Station, Ogden, Utah.

9. USDA Forest Service. 1974. Potential Yield (Annual) 2400-268. Region 3 Forest Service. Albuquerque, New Mexico.

Agencies Contacted for Information

1. USDA Forest Service. Timber Management Office - Gila National Forest. Silver City, New Mexico.

2. USDA Forest Service. Timber Management Office - Apache National Forest. Springerville, Arizona.

3. USDA Forest Service. Timber Management Office - Santa Fe National Forest. Santa Fe, New Mexico.

4. USDA Forest Service. Timber Management Office - Carson National Forest. Taos, New Mexico.

Individuals Contacted for Information

1. Manager, Duke City Lumber Co., Española, NM.

2. Mr. Bill Morton, Southwest Forest Industries, Reserve, NM.

TABLE IV-1. Living Raw Material Tributary to Española, New Mexico.

Geographic Location Source of Information	Carson N.F. Timber Inventory (R-3)		Santa Fe N. F. Timber Inventory (R-3)		Santa Fe County[2] N.M. State Forester		Taos County[2] N.M. State Forester	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Growing stock								
Sawtimber								
Spruce-fir	2,244	2,491	10,631	11,800				
Douglas-fir	1,247	1,122	11,486	10,337				
Limber pine	289	813	303	852				
Ponderosa	2,154	1,953	21,509	19,509				
Aspen	390	603	1,849	2,860				
Total Sawtimber	6,324	6,982	45,778	45,358				
Poletimber								
Spruce-fir	102	592	415	2,396				
Douglas-fir	136	208	1,061	1,622				
Limber pine	N/A	10	N/A	276				
Ponderosa	113	228	791	1,603				
Aspen	1,068	682	1,354	864				
Total Poletimber	1,419	1,720	3,621	6,761				
Seedlings & saplings								
Spruce-fir								
Douglas-fir								
Limber pine								
Ponderosa								
Aspen								
Total Seedlings & saplings	N/A	N/A	N/A	N/A				
Total ST, PT, S&S	7,743	8,702	49,399	52,119	586	144	7,245	3,917
Rough[1]								
Softwood		1,192		6,258				
Hardwood		510		1,955				
Total Rough	N/A	1,702	N/A	8,213				
Rotten[1]								
Softwood				89				
Hardwood				3,863				
Total Rotten	N/A	N/A	N/A	3,952				

NOTE: "N/A" signifies that certain information was not available at the time of this study. In some cases total information was available, but individual data ~~was~~ were not.

[1]From INT-Ogden data

2/ Best available data for N.M.

TABLE IV-1 (Continued)

Geographic Location Source of Information	Rio Arriba County[2] N.M. State Forester		Sandoval County[2] N.M. State Forester		Total of Table IV-1 Living Mtl.	
	Acres	MCF	Acres	MCF	Acres	MCF
←Sawtimber						
Spruce-fir						
Douglas-Fir						
Limber Pine						
Ponderosa						
Aspen						
Total Sawtimber					52,102	52,340
Poletimber						
Spruce-fir						
Douglas-fir						
Limber pine						
Ponderosa						
Aspen						
Total Poletimber					5,040	8,481
Seedlings & Saplings						
Spruce-fir						
Douglas-fir						
Limber pine						
Ponderosa						
Aspen						
Total Seedlings & saplings					N/A	N/A
Total ST, PT, S&S	27,968	14,464	5,368	2,772	98,309	82,118
Rough[1]						
Softwood						
Hardwood						
Total Rough					N/A	9,915
Rotten[(1)]						
Softwood						
Hardwood						
Total Rotten					N/A	3,952

1/ From INT- Ogden data

*No information available for Los Alamos County

2/ Best data available for N.M.

TABLE IV-2. Living Raw Material Tributary to Reserve, New Mexico.

Geographic Location / Data Source	Gila N. F. Gila N.F. Inventory		Apache (Gila) N.F. Apache Inventory		Catron County N.M. State Forestry		Total of Table IV-2 Living Mt'l.	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Growing Stock								
Sawtimber								
Ponderosa pine	40,000	48,050	30,000	31,393				
Douglas-fir[2]	5,902	9,860	4,426	2,408				
Spruce-fir	667	6,000	501	292				
Limber pine	N/A	1,032	N/A	311				
Aspen	0	884	0	12				
Total Sawtimber	46,569	65,826	34,927	34,416	N/A	N/A	81,496	100,242
Poletimber								
Ponderosa	577	4,556	433	2,271				
Douglas-fir[2]	N/A	859	N/A	622				
Spruce-fir	N/A	909	N/A	79				
Limber pine	N/A	181	N/A	89				
Aspen	N/A	426	N/A	8				
Total Poletimber	577	6,931	433	3,069	N/A	N/A	1,010	10,000
Seedlings and Saplings								
Ponderosa								
Douglas-fir								
Spruce-fir								
Limber pine								
Aspen								
Total Seedlings and Saplings	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total ST,PT,SAS	47,146	72,757	35,360	37,485	25,873	6,600	108,379	116,842
Rough[1]								
Softwood		3,637		1,995				
Hardwood		N/A		N/A				
Total	N/A	3,637	N/A	1,995	N/A	N/A	N/A	5,632
Rotten[1]								
Softwood		17		12				
Hardwood		N/A		N/A				
Total	N/A	17	N/A	12	N/A	N/A	N/A	29

1) Forest Survey: Ogden

2) Douglas-fir and limber pine acreage both under Douglas-fir for the sawtimber category

NOTE: "N/A" signifies that certain information was not available at the time of this study. In some cases total information was available but individual data were not.

TABLE IV-3. Dead Raw Material Tributary to Española, New Mexico

Geographic Location	Carson N.F.	Santa Fe N.F.	S & P
	MCF	MCF	MCF
Salvable Dead			
Standing			
Spruce-fir			
Douglas-fir	87	1,982	
Limber pine			
Ponderosa			
Aspen	45	808	
Total Standing	132	2,790	N/A
Down			
Spruce-fir[1]	1,949	9,178	
Douglas-fir	N/A	N/A	
Limber pine			
Ponderosa			
Aspen			
Total Down	1,949	9,178	N/A
Logging Residue			
Spruce-fir	N/A	N/A	
Douglas-fir			
Limber pine			
Ponderosa			
Aspen			
Total Logging Res/yr	27	190	34
Mortality/yr			
Spruce-fir		115	
Douglas-fir		52	
Limber pine		1	
Ponderosa		65	
Aspen		95	
Total Mortality/yr	N/A	328	N/A

1/ For both down & standing dead calculated by using 831 cuft/A(RM-125).

NOTE: "N/A" signifies that certain information was not available at the time of this study. In some cases total information was available but individual data were not.

TABLE IV-4. Dead Raw Material Tributary to Reserve, New Mexico

Geographic Location	Gila N.F.	Apache N.F.	Catron County	Total
	MCF	MCF	MCF	
Salvable Dead				
Standing				
Ponderosa				
Spruce-fir	555 1/			
Douglas-fir		239		
Limber pine				
Aspen		N/A		
Total Standing	555	239	N/A	794
Down				
Ponderosa				
Spruce-fir		1,172		
Douglas-fir				
Limber pine				
Aspen				
Total Down	N/A	1,172	N/A	1,172
Logging Residue				
Ponderosa				
Spruce-fir				
Douglas-fir				
Limber pine				
Aspen				
Total Logging Residue/yr.	175	987	0	1,162
Annual Mortality				
Ponderosa	127	96		
Spruce-fir	108	1		
Douglas-fir	38	53		
Limber pine	6	7		
Aspen	7	3		
Total/yr.	286	160	N/A	446

1/ RM-125 vol of 831 cuft/A of standing and down dead spruce-fir, so figure is for standing and down.

NOTE: "N/A" signifies that certain information was not available at the time of this study. In some cases total information was available, but individual data were not.

TABLE IV-5. Potential Yield & Programmed Allowable Cut for Española, New Mexico

Geographic Location	Carson N.F.[1]		Santa Fe[2]		State & Private[3]	
	Acres	MCF	Acres	MCF	Acres	MCF
Potential Yield (10 years)						
Standard	3,276	1,276	6,692	4,968		
Special	160	13	2,950	491		
Total	3,436	1,289	9,642	5,459	N/A	N/A
Annual Programmed Cut						
Standard	722	222	2,218	1,372		
Special	4	2	990	184		
Total	726	224	3,208	1,556	N/A	280

1/ EIS only for our area
2/ For '75-'77 only
3/ Based on 5% S & P volume for Duke City

NOTE: "N/A" signifies that certain information was not available at the time of this study. In some cases total information was available, but individual data were not.

TABLE IV-6. Potential Yield & Programmed Allowable Cut for Reserve, New Mexico

Geographic Location	Gila N.F. 1/		Apache N.F. 2/		State & Private	
	Acres	MCF	Acres	MCF	Acres	MCF
Potential yield (10 yrs)						
Standard	N/A	14,030	82,250	38,490		
Special	N/A	341	6,075	1,140		
Total	9,581 3/	14,371	88,325	39,630	N/A	N/A
Annual Programmed Cut						
Standard	N/A	1,403	N/A	N/A		
Special	N/A	34	N/A	N/A		
Total	958 3/	1,437	5,400	8,100	0	0

1/ R-3, 2400-26B of 7-1-74
2/ EIS only for N.M. portion of Apache
3/ Assuming 1500 cuft/A

NOTE: "N/A" signifies that certain information was not available at the time of this study. In some cases total information was available, but individual data were not.

TABLE IV-7. Combined Production for Española and Reserve, New Mexico as of November, 1974

1.	Total Annual Input to Mill	
	Lumber	45.5 MMBF
	Poles	2308 Cords [1/]
2.	Average Product Value (Lumber) FOB Mill	$137.50/MBF
3.	Average Milling Cost (Lumber)	$40.00/MBF
4.	Average Raw Material Costs to the Mill (Lumber)	$52.00/MBF
5.	Volume of Residues	
	Chips	15,450 units/yr
	Shavings, sawdust, bark	7,500 units/yr
	Utilization	Chips to Snowflake pulpmill, Española shavings to particleboard plant, all bark and sawdust burned
6.	Average Costs Associated with Residues	N/A
7.	Average Value of Residues	
	Chips	$10/unit
	Bark, shavings, sawdust	N/A [2/]

8. Species used	Española	Reserve
	40%-PP, Fir-30%, Spruce -30%	95% - PP 5% - Fir

1/ To be produced in next 4-5 years then terminated; only production data available

2/ Authors estimate a value of $9.42/unit as hogged fuel. Compared with coal -- an unregulated energy source as to price -- on the basis of equivalent thermal content and with coal valued at $0.69/MMBtu, hogged residue fuel would be valued at $9.42/unit.

NOTE: "N/A" signifies that certain information was not available at the time of the study.

TABLE IV-8. Average Product Costs and Values for Española and Reserve, New Mexico.

	Lumber
Value FOB Mill	$138/MBF
Milling cost	($40/MBF)
Raw material cost delivered to mill	($52/MBF)

TABLE IV-9. U.S. Forest Service Estimates for Production Information in Region 3

		$/MBF
1.	Primary Product Value for Lumber	154-PP
		111 - DF
		97 - WF
		113 - ES
2.	Regional Costs for Milling (Lumber)	$64.20/MBF

3. Raw Material Costs to the Mill[1]

	Española	Reserve
Fell & Buck	$8.87/MBF	$8.87/MBF
Skid	11.07/MBF	11.07/MBF
Load	4.63/MBF	4.63/MBF
Overhead	6.39/MBF	6.39/MBF
Sub Total	$30.96/MBF	$30.96/MBF
Haul Costs	$12.50/MBF	$34.00/MBF
	(50 mi round trip)	(136 mi. round trip)
Total	$43.46/MBF	$64.96/MBF

(1) Using Region -3 appraisal values.

CASE STUDY V: FLAGSTAFF AND WHITERIVER, ARIZONA

Summary

Approximately 790 MM cubic feet of living material can be considered available to Flagstaff, while approximately 720 MM cubic feet of the same type of material is available to Whiteriver. With respect to dead raw material, 5.7 MM cubic feet was considered tributary to Flagstaff. An additional volume of 3.7 MM cubic feet of annual logging residue and mortality was also found to be available to Flagstaff. A volume of salvable dead material amounting to 24.9 MM cubic feet can be considered tributary to Whiteriver, with 6.6 MM cubic feet of logging residue and mortality generated annually available from the land area within the tributary boundary for that processing site.

The total volume of timber used by the two mills located at the two sites was 164 MMBF log scale Scribner Decimal C. There were 63.8 M units of chips produced at the two sites, as well as a combined volume of 51.8 M units of bark, shavings, and sawdust.

The average lumber production cost for November of 1974 was $96.00 per MBF. This cost included the costs of harvesting, transporting and producing the lumber. The average value fob mill of the lumber produced in these areas during that time period was $197 per MBF.

The quality of these data is considered rather good when compared to some of the other sites. Most of the inventory data obtained were current to within the last ten years. The major problem encountered was related to the areas where no inventories had been taken. Also, the inventories needed and obtained were for areas that were totally within the tributary area boundaries. This eliminated any need for taking only parts of available inventories.

The most reliable information concerning the areas tributary to Flagstaff and Whiteriver, Arizona was obtained from the Timber Management Office of the Coconino National Forest and the Fort Apache Indian Reservation, Forestry Division of the Bureau of Indian Affairs. From the latter office it was learned that the entire timber volume tributary to Whiteriver comes from the reservation land. In the case of Flagstaff, timber comes into that processing center from the Coconino National Forest and the Navajo Army Depot located west of Flagstaff, as well as various state and privately owned lands.

The Coconino National Forest Inventory of 1969 and the Fort Apache Indian Reservation Inventory, also of 1969, provided detailed volume data concerning sawtimber and poletimber tributary to the two sites. Data were also available concerning the total volume of sawtimber and poletimber available from the Navajo Army Depot and the state and private lands. It was noted that three different definitions were given for sawtimber and poletimber, corresponding to three of the four different sources queried. No data concerning the volume of seedlings and saplings was obtained from the sources queried. The only source having information concerning the volume of rough and rotten material was the Coconino National Forest.

Detailed information was developed concerning logging residue and mortality on land tributary to Whiteriver. The data for volumes of standing and down dead material on reservation land, however, were negligible. With respect to dead wood material tributary to Flagstaff, only the total standing-dead volume for the Coconino National Forest was available. Information concerning the total volume of logging residue likely to be produced on the various land ownerships was developed for the three areas in question. The only mortality volumes found were for the Coconino National Forest.

The potential yield and programmed allowable cut volumes were available for all three sources tributary to Flagstaff. With respect to Whiteriver, the Fort Apache Indian Reservation in conjunction with their two sawmills is operating at a sustained yield level of 92 MMBF log scale per year.

The economic data from the private sector, obtained through personal contact and correspondence, was understood to be current with respect to November 1974. In both cases the parties involved took care to examine past records in order to determine the correct values. It was found that the two primary wood processors located in the study sites were involved in extensive programs concerning the utilization of all of the raw material that came into their mills, and this included utilization of the residues that they produced. This internal use of residue did, however, interfere with the determination of various costs. The costs associated with the residue were applied to manufacturing overhead and therefore could not be singled out.

In addition to the private sector, data were available from the U.S. Forest Service concerning the average costs and values associated with lumber in Region 3. This information included monthly values for lumber, as well as a breakdown of costs associated with logging and transportation. Comparing the Region 2 averages

for stump-to-mill and manufacturing costs with those given by the producers, it can be seen that the U.S. Forest Service figures are slightly higher than those obtained from the private sources.

Introduction

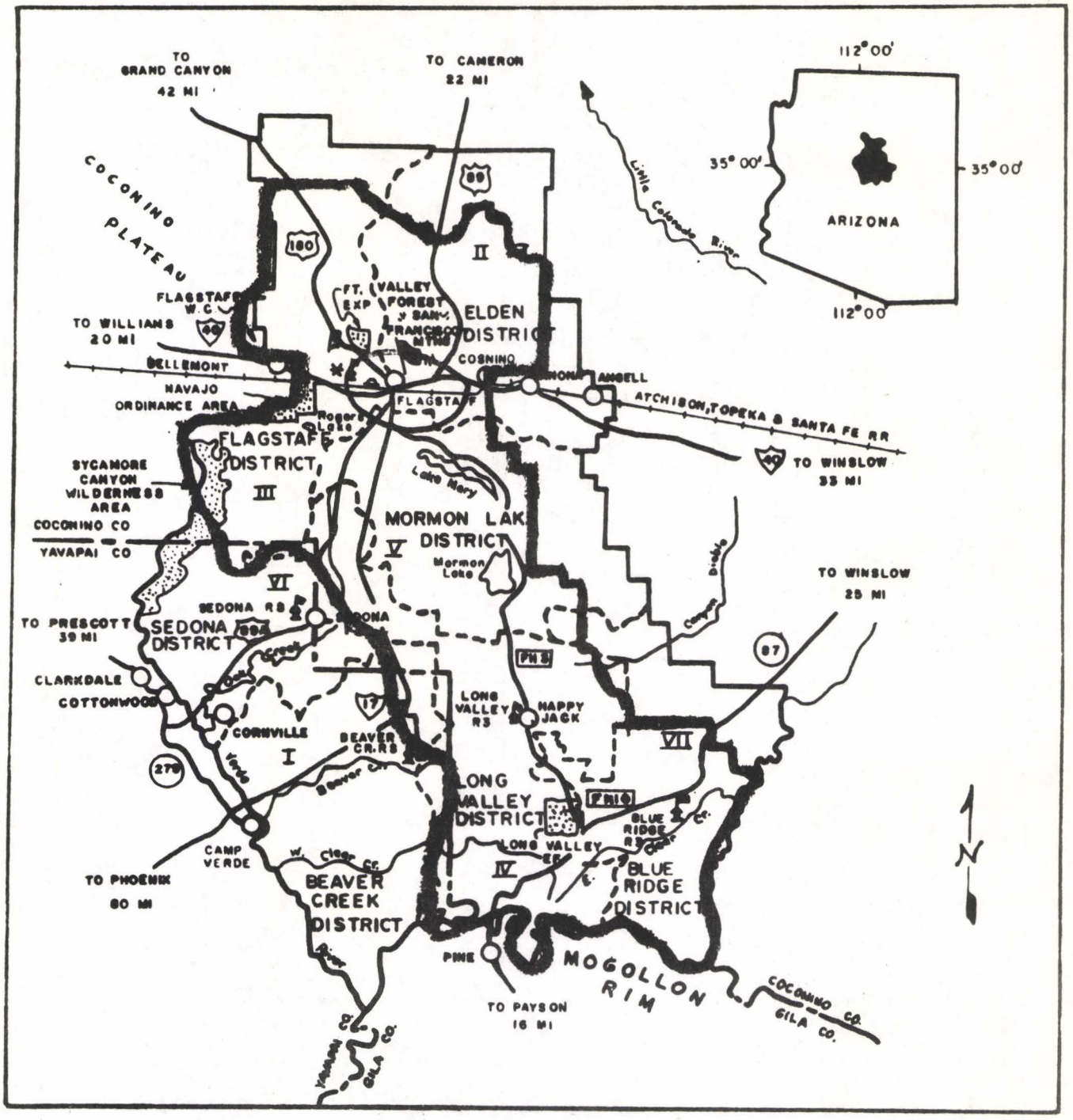
Flagstaff and Whiteriver, Arizona were the two sites chosen for study in that state. Flagstaff is located in the north-central portion of the Coconino National Forest, which is in the center of the state. Interstate 40 traverses Flagstaff from east to west, with U.S. Highway 89 going through in the north-south direction. Flagstaff has rail service. As of March, 1975, there was one forest products firm in operation, and it was producing lumber and particleboard. The commercial species tributary to Flagstaff include Douglas-fir, ponderosa pine, limber pine, white fir and quaking aspen.

Whiteriver, Arizona is located within the boundary of the Fort Apache Indian Reservation, which is in the east-central portion of Arizona. The only highway through Whiteriver is Arizona State Highway 73. Immediate rail service is not available to the community. Only one mill is located in this study site, and it is owned by the White Mountain Apache Tribe, and controlled by the tribal council. The commercial species available to Whiteriver include ponderosa pine, Douglas-fir, white fir, Engelmann spruce, white pine, corkbark fir, and quaking aspen. For the sake of this report, ponderosa pine and white pine were grouped into the pine type, while Douglas-fir, white fir and corkbark fir were included in the mixed conifer type. Engelmann spruce and quaking aspen were reported in the spruce and aspen types, respectively.

The initial information concerning those areas tributary to Whiteriver and Flagstaff, Arizona, was obtained from the U.S. Forest Service, Region 3, Timber Management Office in Albuquerque, New Mexico. In both cases the boundaries were subsequently re-defined by the local forestry personnel at each site. Figures V-1 and V-2 are maps of the areas tributary to Flagstaff and Whiteriver, respectively.

With respect to Whiteriver, local Bureau of Indian Affairs (BIA) officials informed us that the timber tributary to that site comes solely from the Fort Apache Reservation lands. All timber harvested on the reservation land east of U.S. Highway 60 goes directly to the Indian-owned Fort Apache Timber Company mill located in Whiteriver. All timber from the western side of U.S. 60 goes to another tribal mill at Cibecue, Arizona. At Cibecue the timber is cut into green

Figure V-1. Area tributary to Flagstaff, AZ.



LOCATION MAP

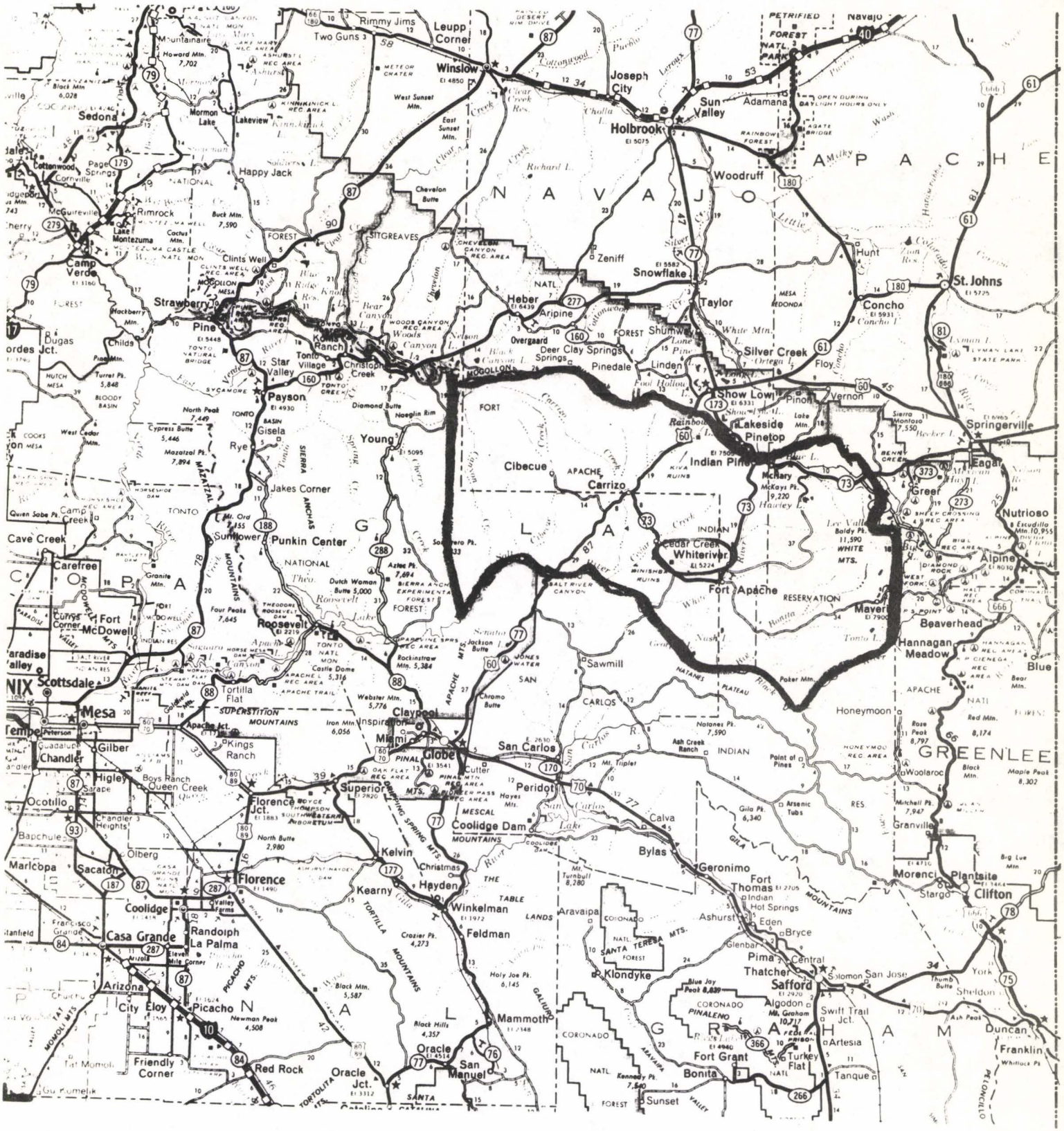
COCONINO NATIONAL FOREST

R-3

Scale 1 0 2 4 6 8 10 Miles

- Forest boundary
- Ranger district boundary (coincides with block boundary)
- County line
- Boundary of Flagstaff sustained yield area
- Supervisors headquarters
- Ranger station
- Ranger district headquarters at Flagstaff for Elden, Mormon Lake and Flagstaff
- 89 Federal
- (79) State
- 4137 Forest
- Railroad
- Mfg. facilities
- (17) Interstate

Figure V-2. Area tributary to Whiteriver, AZ.


Rimmy Jims
Two Guns
Leupp Corner
Winslow
Joseph City
Holbrook
Sun Valley
Adamana
Navajo
Petrified Forest Natl. Park
Sedona
Mountainaire
Howard Mtn. 7,702
Mormon Lake
Lakeview
Happy Jack
Cottonwood
Page Springs
Cornville
McGuireville
Rimrock
Lake Montezuma
Camp Verde
Clints Well
Strawberry
Pine
Bugas
Childs
Star Valley
Payson
Tonto Village
Christopher Creek
Kohl's Ranch
Heber
Aripine
Overgaard
Deer Springs
Clay Springs
Pinedale
Linden
Zeniff
Snowflake
Taylor
Shumway
Silver Creek
Show Low
Pinon
Vernon
Hunt
St. Johns
Concho
Springerville
Eagar
Greer
Nutrioso
Alpine
Beaverhead
Hannagan Meadow
Blue
Honeymoon
Morenci
Plantsite
Clifton
Stargo
Granville
Gila
Bylas
Geronimo
Fort Thomas
Ashurst
Eden
Bryce
Glenbar
Pima
Central
Thatcher
Solomon
San Jose
Safford
Algodon
Swift Trail Jct.
Artesia
Duncan
Franklin
Fort Grant
Bonita
Turkey Flat
Tanque
Sunset
Oracle
San Manuel
Mammoth
Oracle Jct.
Red Rock
Friendly Corner
Picacho
City Eloy
Arizona
Casa Grande
Randolph
La Palma
Coolidge
Florence
Sacaton
Maricopa
Olberg
Bapchule
Ocotillo
Chandler Heights
Higley
Queen Creek
Gilbert
Chandler
Mesa
Scottsdale
Tempe
Paradise Valley
Fort McDowell
Currys Corner
Carefree
Cave Creek
Camp Creek
Quien Sabe Pk.
Sunflower
Punkin Center
Roosevelt
Tortilla Flat
Apache Jct.
Kings Ranch
Superior
Florence Jct.
Coolidge Dam
Kelvin
Christmas
Hayden
Winkelman
Feldman
Kearny
Claypool
Miami
Inspiration
Globe
San Carlos
Peridot
Cutter
Sawmill
Jones Water
Chromo Butte
Young
Gisela
Rye
Jakes Corner
Diamond Butte
Naegelin Rim
Cibecue
Carrizo
Indian Pine
McNary
Lakeside
Pinetop
Show Low
Whiteriver
Cedar Creek
Fort Apache
Reservation
Maverick
Salt River Canyon
Natanes Plateau
Poker Mtn.
Carlos
Aravaipa
Klondyke
Coronado
Pinaleno
Mts.
Graham
Mts.
Black Mtn.
Mt. Turnbull
Holy Joe Pk.
Galiuro
Mts.
Table Lands
Tortilla Mts.
Picacho Mts.
Superstition Mts.
Sierra Ancha Mts.
Mazatzal Mts.
Four Peaks
Mt. Ord
Mazatzal Pk.
Cypress Butte
Aztec Pk.
Dutch Woman Butte
Webster Mtn.
Rockinstraw Mtn.
Castle Dome
Iron Mtn.
Jackson Butte
Mt. Triplet
Ash Creek Ranch
Point of Pines
Arsenic Tubs
Mitchell Pk.
Red Mtn.
Maple Peak
Woolaroc
Black Mtn.
Honeymoon
Natanes Pk.
Baldy Pk.
White Mts.
Sierra Montosa
Escudilla Mtn.
Diamond Rock
Lee Valley
Sheep Crossing
Bear Mtn.
Big Lue Mtn.
Thumb Butte
Ash Peak
Sheldon
York
Mt. Graham
Navajo
Apache
Greenlee
Graham
Cochise
Pinal
Gila

lumber and shipped to Whiteriver. There it is dried, planed, and otherwise processed with that timber from the eastern side of U.S. 60. Because the wood raw material is eventually combined at the mill in Whiteriver, all of the reservation's timber was considered tributary to that site.

In Flagstaff, Southwest Forest Industries, Inc. was the only firm in operation at the time of the study. They are under a long-term contract to harvest 85 percent of the annual cut on the Coconino National Forest. Southwest is also required to take 85 percent of the timber earmarked for salvage from the Coconino National Forest. The additional timber needed to satisfy Southwest's demand is procured from the Navajo Army Depot located just west of Flagstaff and from state and privately-owned land in the tributary area.

The timber management office of the Coconino National Forest indicated that 6000 acres of the South Kaibab National Forest is included in the same Sustained Yield Unit which specifies the 85 percent cut stipulation for Southwest Forest Industries. Approximately 3000 board feet per acre were harvested from this land source in 1973. However, it was learned that no further harvesting will occur on this land within the next 20 years. Because this study is looking at those timber sources tributary to a study site currently available or available within the next ten years, the South Kaibab National Forest was not considered as a consistent raw material source. For this reason its contribution was not considered in this analysis.

Living Raw Material

Whiteriver

The volumes of living material tributary to Whiteriver, Arizona, were obtained from the Forestry Division of the local Bureau of Indian Affairs. The information provided was based on an inventory completed in November 1969 for commercial forest land. The volumes of the various species within each stand-type class were obtained from this inventory. The volumes of trees within the classifications of virgin timber, residual timber, and young timber were combined and used to develop the sawtimber volumes. These are trees with a dbh greater than 11 inches. The pole-timber volumes were obtained directly from the inventory data. This group included trees from 5 to 11 inches dbh. The area of each primary species within its type class was also obtained from the Fort Apache Indian Reservation Inventory of 1969. The resulting areas and volumes of living material for this site are given in Table V-2.

Flagstaff

The information concerning the amount of living material available to Flagstaff came from several sources. With respect to the Coconino National Forest, a timber inventory, circa 1969, was obtained from the Timber Management Office of Region 3, and was used in developing the raw material information from that land area. Even though a current timber management plan was available it was not used because its information contained no volumes by species and stand-size class. The management plan did have the land areas segregated by stand-size class, so this information was used.

The area and volume figures in Table V-1 represent only the standard and special components of the commercial forest land within the Coconino National Forest, and exclude the marginal and unregulated components. The total land acreage classified as either standard or special was 580,176 acres. No means were provided to segregate this acreage figure into a species classification. Therefore, only the total acreage was presented for each stand-size class on the commercial forest land tributary to Flagstaff from the Coconino National Forest. The volume information, however, could be segregated by species and stand-size class, with the timber measuring from 5 to 9 inches dbh classified as poletimber and sawtimber as that timber 10 inches dbh and larger.

The volumes of rough and rotten timber, both for hardwoods and softwoods, are also found in Table V-1. The land area for this classification was not available. The volume for the rough and rotten timber on the Coconino National Forest was obtained from information provided by the Forest Survey Unit.

With respect to the raw material contribution from the Navajo Army Depot to Flagstaff, only the total sawtimber and poletimber volumes were available for accessible timber. This information was obtained through correspondence with the depot's forester, and is shown in Table V-1 for the tributary area.

Information concerning state and private lands was obtained from the State Forestry Division, Arizona State Land Office located in Flagstaff, Arizona. The information presented in Table V-1, regarding state and private data, reflects the available volume of sawtimber and poletimber tributary to Flagstaff from those two sources. It should be added that in this inventory, poletimber ranged from 5 to 11.5 inches dbh, with sawtimber including those trees with a dbh greater than 11.5 inches. Finally, no information concerning the volume of rough and rotten

material was available from either the Navajo Army depot or the Arizona State Land Department. Likewise, volume information concerning seedlings and saplings was not obtained from any of the sources examined.

Dead Raw Material

Whiteriver

Information concerning the amount of standing dead material tributary to Whiteriver had to be obtained from several sources. First of all, no volume information was obtained directly from the reservation's timber inventory. This necessitated using per acre volumes that are available from the literature. Sampson et al. have stated that there is little or no reason to expect much yield from dead or down trees in ponderosa pine timber stands. Their study related to Arizona. For these reasons it was assumed that the volume in this particular category was negligible. The same publication was also referenced with regard to the amount of standing and down dead spruce available to Whiteriver. The per acre factor of 831 cu. ft., chich was developed in Sampson's study, was multiplied by the available acreage figure for the spruce type. It should be noted that this value for dead spruce was for an area in southern Colorado. This value is given in the standing dead portion of Table V-4. It is presented under standing dead because the percent of standing versus down is not available. No information was obtained for the volume of standing dead material found in the mixed conifer or aspen type stands. Likewise, no data were available concerning the volume of down material tributary to Whiteriver.

The volume of accessible logging residues generated on an annual basis for the next ten years is also shown in Table V-4. From Bureau of Indian Affairs forestry official, it was learned that 65 percent of the harvest would be from the pine type, with 25 percent and 10 percent coming from the mixed conifer type and spruce type, respectively. These percentages were multiplied by the projected annual cut of 92 MM board feet (18.4 MM cubic feet). The resulting expected annual harvest for each species was then multiplied by 12.2 percent, the factor given by Setzer et al., for logging residue in Arizona. This resulted in the expected annual logging residue for that area tributary to Whiteriver.

The annual mortality values for each species, on the land tributary to Whiteriver was obtained from the local BIA forestry office. The average annual mortality per acre is 8, 8, and 14 cubic feet for pine, mixed conifer and spruce types, respectively. These factors were multiplied by the total land area of each species type giving the mortality volumes. These are shown in Table V-4.

Flagstaff

Little information was available regarding the amount of dead material available to Flagstaff. The only data concerning standing dead material was the total volume from the Forest Survey Unit, Ogden, Utah for the Coconino NF. This volume represents that quantity of material on land components classified as either standard or special. This is the material that is currently available. This information is presented in Table V-3. No species breakdown of the dead volume could be developed. With respect to the Navajo Army Depot land and the state and private land, no information concerning standing dead material was available. As for the volume of down-dead material no data were received from any of the three sources contacted.

The total volume of logging residue that could be available to Flagstaff is presented in Table V-3. The volumes presented were developed by multiplying the quantities of timber to be harvested annually from the three land segments tributary to Flagstaff by the logging residue factor of 12.20 percent of the harvested volume given by Setzer et al.

Mortality information on land considered tributary to Flagstaff was obtained from data presented in the 1969 Coconino National Forest Inventory. Again, the mortality information presented in Table V-3 represents that volume of annual mortality that is available. This was accomplished by reporting only that quantity that would come from the standard and special components of the forest.

Potential Yield and Programmed Allowable Cut

According to the forestry officials on the Fort Apache Indian Reservation, the sustained yield of the reservation's commercial forest land is 92 MMBF or 18.4 MMCF per year. The expected harvest for 1975 is planned to reach that limit. This will be the first year that the reservation will be operating at this level. They do not plan on increasing this level of production. This information is depicted in Table V-5.

The annual potential yield and programmed allowable cut for the land tributary to Flagstaff is also presented in Table V-5. The Coconino National Forest data were readily available from the 1973 Timber Management Plan. Information concerning the other land areas tributary to Flagstaff was obtained through correspondence with the Navajo Army depot and the State Land Office. With respect to the state and private source, the values presented in Table V-5 represent the estimated input from that source to Flagstaff. The expected annual contribution from the Navajo

Army Depot is also given in Table V-5. For both the depot land and the state and private land, the number of acres to be harvested was not known.

Primary Wood Processors' Information

The two sources of production information from the private sector included Southwest Forest Industries, Inc., in Flagstaff, and Fort Apache Timber Company in Whiteriver. These two firms were the only primary processors operating at the time of our study. One other firm in Flagstaff, the Kaibab Moulding Company, is phasing out its operation. For this reason its input was not included in this report. Table V-6 shows the total combined log input to the two mills. The combined by-product output is also given in Table V-6. The average costs incurred in getting the raw material to the mill, as well as the milling costs are included, together with the average product value for lumber. The various uses for the by-products are also included. It was difficult for the firms in question to ascertain the costs associated with the utilization of their various by-products. There was a great variation in chip prices. Chips went to Snowflake, Arizona in both cases. The net value of sawdust and shavings was also obtained. This is included in Table V-6, as is the list of the various species utilized at the two processing sites. Table V-8 is a summary of the various costs and values associated with the primary wood product at these sites.

Table V-7 illustrates the economic information concerning the area as developed by the U.S. Forest Service. All of the values shown are averages for Region 3. The information was obtained from the U.S. Forest Service Region 3, 2470 Appraisal Bulletin Number 4, for April 1975. This bulletin is published periodically and contains past, present and future expected values for lumber. It also contains regional averages for stump-to-mill costs and manufacturing costs.

With respect to stump-to-mill costs, all costs except for transportation were listed explicitly in the bulletin. The transportation costs were developed as follows: the average haul distances for a round trip were multiplied by the average cost per mile per thousand board feet. An average round trip haul of 64.5 miles was used for both sites. With respect to Flagstaff, this value for round-trip mileage was developed by the timber management personnel on the Coconino National Forest. The same value was used for Whiteriver since the average distance in the four primary directions from Whiteriver to the reservation border was thirty miles. This resulted in an average round-trip distance of sixty miles. After consideration of curves and grades, 64.5 miles was deemed justifiable and

was adopted for convenience. Finally, the cost of manufacturing lumber according to U.S. Forest Service data, was for April of 1975 -- an unavoidable departure from the study target date of November, 1974.

References

1. Miller Freeman Publications. 1975. 1974 Director of Forest Products Industry. San Francisco, California.

2. Sampson, George R., Harold Worth, and Dennis M. Donnelly. 1974. Demonstration Test of Inwoods Pulp Chip Production in the Four Corners Region. USDA Forest Service Res. Pap. RM-125, pp-9. Fort Collins, Colorado.

3. Setzer, T. S., A. K. Wilson, and G. A. Choate. 1973. Logging Residues on Sawlog Operations, Arizona and New Mexico. USDA Forest Service Res. Paper INT-78. Intermountain Forest and Range Experiment Station, Ogden, Utah.

4. USDA Forest Service. 1973. Seventh Revision Timber Management Plan, Coconino National Forest. USDA Forest Service; Region 3 Headquarters, Albuquerque, New Mexico.

5. USDA Forest Service. 1975. 2420-Appraisal Bulletin Number 4, April 1975; Price Trends of Lumber from the Western Pine Region. U.S. Forest Service, Region 3, Albuquerque, New Mexico.

6. USDA Forest Service. 1975. Potential Yield for Entire Region 3 National Forest Land. U.S. Forest Service, Region 3, Albuquerque, New Mexico.

7. USDA Forest Service. 1969. Coconino National Forest Timber Inventory. U.S. Forest Service, Region 3, Albuquerque, New Mexico.

8. USDA Forest Service. 1975. Inventory of Cull and Salvable Timber for Arizona as of 1970. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah.

9. U.S. Department of Interior. 1969. Forest Inventory Fort Apache Indian Reservation, Bureau of Indian Affairs, Whiteriver, Arizona.

Agencies Contacted for Information

1. Arizona State Land Department, State Forestry Division, Flagstaff, Arizona.

2. Coconino National Forest, Timber Management Division, Flagstaff, Arizona.

3. Department of the Army, Navajo Depot Activity, Flagstaff, Arizona.

4. Fort Apache Indian Reservation Bureau of Indian Affairs, Forestry Division, White River, Arizona.

5. U.S. Forest Service, Region 3 Headquarters, Albuquerque, New Mexico.

6. U.S. Forest Service Forest Survey Unit, Intermountain Forest and Range Experiment Station, Ogden, Utah.

Individuals Contacted for Information

1. Mr. R. E. Stermitz, Vice President, Southwest Forest Industries, Flagstaff, Arizona.

2. Mr. R. A. Blaser and Mr. Andy Hoskot, Southwest Forest Industries, Flagstaff, Arizona.

3. Mr. Hal Butler, Fort Apache Timber Company, Whiteriver, Arizona.

TABLE V-1. Living Raw Material Tributary to Flagstaff, Arizona.

Geographic Location / Information Source	Coconino Nat'l Forest 1969 Timber Inv.		Navajo Army Depot 1969 Timber Inv.		State & Private State Forestry Office		Total of Table V-1 Living Mtl	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Sawtimber								
Douglas-fir type		5,180						
Ponderosa pine		586,886						
Limber pine		1,258						
White fir		2,471						
Aspen		12,227						
Total Sawtimber	487,053	608,022	N/A	8,441	N/A	21,200	487,053	637,663
Poletimber								
Douglas-fir type		1,049						
Ponderosa pine		103,090						
Limber pine		822						
White fir		72						
Aspen		1,005						
Total Poletimber	66,362	106,038	N/A	3,792[1]	N/A	17,170	66,362	127,000
Seedling & Saplings								
Douglas-fir type								
Ponderosa pine								
Limber pine								
White fir								
Aspen								
Total Seedling & Saplings	26,761	N/A	N/A	N/A	N/A	N/A	26,761	N/A
Rough								
Softwood		18,478						
Hardwood		3,862						
Total Rough	N/A	22,340	N/A	N/A	N/A	N/A	N/A	22,340
Rotten								
Softwood		885						
Hardwood		1,751						
Total Rotten	N/A	2,636	N/A	N/A	N/A	N/A	N/A	2,636

1) Volumes represent pulpwood 5" to 11.5" dbh.

Note: "N/A" signifies that certain information was not available at the time of this study.

TABLE V-2. Living Raw Material Tributary to Whiteriver, Arizona

Geographic Location	Fort Apache Indian Res. 1969 Timber Inventory	
	Acres	MCF [1]
Sawtimber		
Pine	357,494	419,954
Mixed conifer	129,895	117,846
Spruce	29,972	141,136
Aspen	14,725	40,073
Total Sawtimber	532,086	719,009
Poletimber		
Pine	7,536	1,198
Mixed Conifer	46	18
Spruce	0	0
Aspen	738	396
Total Poletimber	8,320	1,612
Seedlings & Saplings		
Pine		
Mixed Conifer		
Spruce		
Aspen		
Total Seedlings & Saplings	N/A	N/A
Rough		
Softwood		
Hardwood		
Total Rough	N/A	N/A
Rotten		
Softwood		
Hardwood		
Total Rotten	N/A	N/A

[1] Values represent volume of particular species within its respective timber type

Note: "N/A" signifies that certain information was not available at the time of this study.

TABLE V-3. Dead Raw Material Tributary to Flagstaff, Arizona.

Geographic Location	Coconino N.F.	Navajo Army Depot	State & Private
	MCF	MCF	MCF
Standing Material			
Douglas-fir type			
Ponderosa pine			
Limber pine			
White fir			
Aspen			
Total Standing	5,704	N/A	N/A
Down Material			
Douglas-fir type			
Ponderosa pine			
Limber pine			
White fir			
Aspen			
Total Down	N/A	N/A	N/A
Logging Residue /year			
Douglas-fir type			
Ponderosa pine			
Limber pine			
White fir			
Aspen			
Total Logging Res/ yr	2,351	34	56
Mortality/yr			
Douglas-fir type	216		
Ponderosa pine	1,045		
Limber pine	N/A		
White fir	N/A		
Aspen	38		
Total Mortality/yr	1,299	N/A	N/A

Note: "N/A" signifies that certain information was not available at the time of this study.

TABLE V-4. Dead Raw Material Tributary to Whiteriver, Arizona.

Geographic Location	Fort Apache Indian Res.
	MCF
Standing Material	
Pine type	0
Mixed conifer	N/A 2/
Spruce	24,903 2/
Aspen	N/A
Total Standing	24,903
Down Material	
Pine type	
Mixed conifer	
Spruce	
Aspen	
Total Down	N/A
Logging Residue/yr 1	
Pine type	1,459
Mixed conifer	562
Spruce	224
Aspen	0
Total Logging Res/Yr	2,245
Mortality /year	
Pine type	2,920
Mixed conifer	1,039
Spruce	419
Aspen	N/A
Total Mortality /year	4,378

1/ Based on 65% - Pine
25% - Mixed Conifer
10% - Spruce

2/ Standing and Down

Note: "N/A" signifies that certain information was not available at the time of this study.

TABLE V-5. Potential Yield and Programmed Allowable Cut for Flagstaff and Whiteriver, Arizona.

Geographic Location	Coconino N.F.[1]		Navajo Army Depot[2]		State & Private		Ft. Apache Indian Res.	
	Acres	MCF	Acres	MCF	Acres	MCF	Acres	MCF
Annual Potential Yield								
Standard:								
Sawtimber		13,890		247		250		
Roundwood		5,372		59		212		
Sub-Total	38,000	19,262	N/A	306	N/A	462	N/A	N/A
Special:								
Sawtimber		81						
Roundwood		0						
Sub-Total	1,000	81	N/A	N/A	N/A	N/A	N/A	N/A
Total	39,000	19,343	N/A	306	N/A	462	N/A	18,400
Programmed Allowable Cut								
Sawtimber		14,480		220		250		
Roundwood		720		59		212		
Total	41,970	15,200	N/A	279	N/A	462	N/A	18,400

1/ 1973 TMP for Coconino
2/ Information obtained from state forester

Note: "N/A" signifies that certain information was not available at the time of this study. In some cases, total information was available, but individual data or subtotals were not.

TABLE V-6. Combined Production Information for Flagstaff, Arizona and Whiteriver, Arizona as of November, 1974.

Total Input (Log Scale) of Primary Product Raw Material (Annual)	164 MMBF
Avg. Value of Lumber Product FOB Mill	$197/MBF
Avg. Milling Cost of Lumber per MBF	$53.43/MBF
Avg. Raw Mat'l. Cost to the Mill	$42.50 MBF (Green Material) 50.00/MBF (Dead Material)
Total Manufacturing Residue volume (Annual)	Chips (Bone dry) 63.8 M units Bark, shavings & sawdust 51.8 M units
Uses of Residue	Chips for Snowflake pulp mill Planer shavings and sawdust for particleboard (Flagstaff). Planer, bark and sawdust used as fuel.
Avg. Cost Associated with Residue and By-products	N/A chips, shavings & sawdust $34.00/ unit handling for fuel
Avg. Net Value of Residue By-products FOB Mill	$17.50/unit - chips $3.00/unit - sawdust and shavings 1/ Bonedry unit
Species used	Ponderosa pine, Engelmann spruce, Douglas-fir, white fir

1/ By authors estimate, compared with coal -- an unregulated energy source as to price -- on the basis of equivalent thermal content and with coal valued at $0.69/MM BTU, hogged residue fuel would be valued at $9.42/unit.

TABLE V-7. U.S. Forest Service Estimates for Production Information in Region 3.

Product Value (Lumber/MBF)	Ponderosa Pine		$154.34
	Douglas-fir		111.48
	White fir		96.95
	Engelmann spruce		113.47
Raw Material Costs to the Mill	$8.87	Fell and buck	
	11.07	Skid	
	4.63	Load	
	6.39	Overhead	
	16.13	Transportation	
	$47.09	Total	
Manufacturing Costs (Lumber/MBF)	$64.20	April 1975	

TABLE V-8. Average Product Costs and Values for Whiteriver, Arizona and Flagstaff, Arizona.

Value of Lumber FOB Mill	$197/MBF
Raw Material Cost Delivered to Mill	(42.50/MBF)
Milling Cost (Lumber)	(53.43/MBF)